

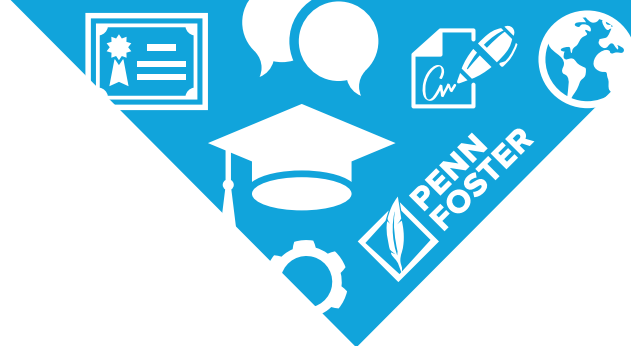
Course Introduction

Use the arrows at the top right of your page to navigate through your learning.



Jewelry Design and Repair

PROGRAM OUTLINE



PROGRAM GOAL AND OUTCOMES

Program Goal

Penn Foster's Jewelry Design and Repair Program instructs the student in the skills necessary to create, repair, and modify jewelry, including stone setting, sizing, and polishing, in order to work for an established jeweler or start a business of their own.

Program Outcomes	Lessons	Evidence of Learning
Identify the tools and supplies needed to establish a jeweler's bench and perform successful repairs	The Bench Jeweler's Tools	Multiple-choice lesson exams
Identify the properties of precious metals, how to weigh the amount of precious metal in an alloy, and how to calculate value	History of Jewelry and a Summary of Metals	Multiple-choice lesson exams
Design a pattern following appropriate design elements, and from raw materials create clean, well-formed and finished monogrammed jewelry including a bail	Project 1: Creating a Monogram Pendant	Multiple-choice lesson exams
	Graded Project 1: Monogram Earrings	Graded project
	Jewelry Design	Multiple-choice lesson exams
Solder jewelry parts by choosing the correct torch, fuel, solder, flux, and flame for a particular job, and utilizing the proper soldering methods	Soldering	Multiple-choice lesson exams
	Graded Project 3: Three-Stone Prong-Set Band	Graded project
Enlarge or shrink rings by using a mandrel, adding an insert, or removing a piece of the ring to preserve the ring's design and roundness	Ring Sizing	Multiple-choice lesson exams
	Graded Project 4: Wedding Band Resizing	Graded project
Comprehend how to cut and bend individual links and jump rings from raw materials	Project 2: Link Identification Bracelet	Multiple-choice lesson exams
Comprehend how to make a wax model by carving or casting in a rubber mold, mix and cure investment, burn off the wax model, and fill a cast with molten metal using the gravity pour, vacuum, or centrifugal casting processes	Casting	Multiple-choice lesson exams
	Mold Making	Multiple-choice lesson exams
	Project 3: Stone-Set Pendant	Multiple-choice lesson exams
Comprehend business and sales models used in the jewelry industry, the pricing structure of keystoneing, and methods of work distribution and work flow	Jewelry Retailing Home-Based Business	Multiple-choice lesson exams
	Jewelry Retailing Store-Based Business	Multiple-choice lesson exams

Identify the chemical composition and characteristics of some common gemstones and the factors that contribute to their market value	Colored Gemstones and Diamonds	Multiple-choice lesson exams
Demonstrate procedures for performing quality repairs on common items such as metal chains, quartz watches, and pearl necklaces, and the standards for pricing the work performed	Common Jewelry Store Repairs	Multiple-choice lesson exams
	Graded Project 2: Chain Resizing	Graded project
Build a sterling silver bezel-set ring by hand from raw materials	Project 4: Bezel-Set Onyx Ring	Multiple-choice lesson exams
Size, cut, and solder a 3-layer ring band, measure and place prong settings, and mount gemstones into the prongs	Stone Setting	Multiple-choice lesson exams
	Project 5: Three-Stone Prong-Set Band	Multiple-choice lesson exams
	Graded Project 3: Three-Stone Prong-Set Band	Graded project

PROGRAM STRUCTURE

Instruction Set 1

Lesson 1

Starting Your Program

Lesson 2

The Bench Jeweler's Tools

Instruction Set 2

Lesson 3

History of Jewelry and a Summary of Metals

Lesson 4

Monogram Pendant

Learning Aids

Saw frame

Packet of saw blades

Hardwood bench pin

6-in. double-cut file

High-speed twist drill bit

Brass sheet

Packet of jump rings

Polishing cloth

Gesswein catalog request form

Instruction Set 3

Lesson 5

Soldering

Lesson 6

Ring Sizing

Lesson 7

Link Identification Bracelet

Learning Aids

Propane torch tip

Spark lighter

Easy silver wire solder

14-gauge round brass wire

20-gauge brass sheet

Safety goggles

Unlined nitrile gloves (1 pair)

Pickling compound (½ oz. packet)

Cross-locking tweezers

Instruction Set 4

Lesson 8

Casting

Lesson 9

Mold Making

Lesson 10

Stone-Set Pendant

Learning Aids

Round brass wire (3 pcs.)

Green carving wax

Small cuttlebone

Lead-free wire solder (1 oz.)

Simulated garnet (packet of four)

Instruction Set 5

Lesson 11
Lesson 12
Lesson 13
Lesson 14
Learning Aids

Jewelry Retailing: Home-Based Business
Jewelry Retailing: Store-Based Business
Monogram Earrings
Chain Resizing
Brass sheet (1 in. × 3 in.)
Brass French ear wires (2 pairs)
#2 saw blades (packet of 48)
Wire solder and flux
4.25-mm white-finished brass double cable chains (2)
Padded mailing envelopes (2)

Instruction Set 6

Lesson 15
Lesson 16
Lesson 17
Learning Aids

Colored Gemstones and Diamonds
Common Jewelry Store Repairs
Bezel-Set Onyx Ring
Steel ring mandrel
Oval black onyx (14 mm × 10mm)
Sterling silver bezel wire
26-gauge sterling silver sheet (½ in. × ¾ in.)
20-gauge sterling silver sheet (¼ in. × 2¾ in.)
Needle file
Binding wire
Easy paste solder
Medium paste solder
Round nose pliers
Copper tongs
Pickling compound (½ oz. packet)
Color supplement—Gemstone Gallery
Magnesia soldering block

Instruction Set 7

Lesson 18
Lesson 19
Lesson 20
Lesson 21
Lesson 22
Learning Aids

Stone Setting
Jewelry Design
Three-Stone Prong-Set Band
Three-Stone Prong-Set Band
Wedding Band Resizing
Two-speed rotary tool
Bristle brush accessory for rotary tool
9-in. gold-filled wire
4-in. sterling silver wire
Sterling silver settings (6)
Round cubic zirconias (6)

4-mm sterling wedding bands (2, sizes 6 and 9)

Medium silver paste solder (1 syringe)

Easy silver paste solder (1 syringe)

Padded mailing envelopes (2)

Jewelry Design

Work Experience Option

LESSON DESCRIPTIONS AND OBJECTIVES

Starting Your Program

Succeed by learning how to use your Penn Foster program.

By the end of this lesson, you'll be able to:

- Understand how to use your Student Portal.
- Access the Penn Foster Community and use it to find answers.
- Connect with Penn Foster on various social media sites.

The Bench Jeweler's Tools

Explore the components of a bench jeweler's work area.

By the end of this lesson, you'll be able to:

- Demonstrate how to construct a portable work area.
- Explain the parts and purpose of a flexible shaft machine.
- Identify the types and sizes of sawblades, files, and drills.
- Demonstrate the proper procedures for sawing, filing, and drilling.
- Identify the various types of pliers and hammers and explain their uses.
- Demonstrate how bench jewelers use mandrels, anvils, vises, and magnifiers.

History of Jewelry and a Summary of Metals

Get an overview of the history and development of the art of jewelry through the ages.

By the end of this lesson, you'll be able to:

- Explain how metals are used in making coins, industrial items, and jewelry.
- Demonstrate techniques used to mix gold and silver with other metals to produce varying degrees of hardness and color.
- Understand the effects of heating and cooling on jewelry metals as you learn how to make metals harder or softer.
- Demonstrate the proper procedure for cleaning and finishing techniques, including filing, sanding, and polishing.

Project 1: Monogram Pendant

Create your first piece of jewelry! Practice your skills by training your mind and hands to work together for the basic operations of sawing, filing, drilling, and finishing.

Soldering

Learn how to use solder to create or repair jewelry.

By the end of this lesson, you'll be able to:

- Identify the different methods and types of fuels and torches that can be used to solder.
- Recognize neutral and oxidizing flame characteristics.
- Demonstrate how to repair bracelets, chains, and other jewelry items.

Ring Sizing

This lesson will teach you how to resize different types of rings.

By the end of this lesson, you'll be able to:

- Understand the different techniques and approaches to sizing rings.
- Identify the tasks and problems involved in ring sizing.
- Demonstrate how to size simple bands, rings containing stones, and special rings for people with arthritis.
- Understand how to properly use a mechanical ring sizer to size rings.

Project 2: Link Identification Bracelet

In this lesson, you'll create a chain-link bracelet!

By the end of this lesson, you'll be able to:

- Create and solder links.
- Fabricate jump rings and solder them to other bracelet parts.
- Sand and finish the completed bracelet.

Casting

In this lesson, you'll learn how to use liquid metal alloy to create jewelry pieces.

By the end of this lesson, you'll be able to:

- Create functional models out of wax.
- Properly invest items to be cast.
- Understand the vacuum and centrifugal casting processes.
- Recognize and correct casting defects.

Mold Making

Learn how to use molding to create unique pieces of jewelry.

By the end of this lesson, you'll be able to:

- Understand the purpose of molding, including its advantages and disadvantages.
- Properly create and pack a rubber mold.
- Inject the mold with wax to create a reproduction.
- Mold an object using liquid silicone.
- Explore the steps involved in electroplating.

Project 3: Stone-Set Pendant

Create a stone-set pendant.

By the end of this lesson, you'll be able to:

- Learn various wax modeling techniques.
- Carve a basic wax model for casting.

- Create a casting from metal.
- Set a gemstone in the finished pendant.

Jewelry Retailing: Home-Based Business

Get insider tips on how to develop your own home-based jewelry business.

By the end of this lesson, you'll be able to:

- Assess your personal and professional goals.
- Create a business plan based on those goals.
- Know how to register your business and obtain a sales tax license.
- Understand methods of marketing and selling your jewelry.
- Recognize how to set up your home office.

Jewelry Retailing: Store-Based Business

Get tips on personal selling and basic selling techniques.

By the end of this lesson, you'll be able to:

- Recognize the types of retailers and industry trends.
- Know how to identify a target market.
- Identify the characteristics of a retail jewelry business.
- Understand how store location, decor, layout, and displays can enhance a business's image and increase sales.
- Understand the basic functions of all retail operations.

Graded Project 1: Monogram Earrings

Craft earrings to match the pendant you made earlier in Project 1.

Graded Project 2: Chain Resizing

Resize two chains to form one necklace and one bracelet.

Colored Gemstones and Diamonds

In this lesson, you'll learn the characteristics of diamonds, rubies, sapphires, and other gemstones.

By the end of this lesson, you'll be able to:

- Identify, grade, and evaluate popular gemstones.
- Understand how diamonds are formed, mined, marketed, cut, and graded.

Common Jewelry Store Repairs

Learn the steps involved in making common repairs.

By the end of this lesson, you'll be able to:

- Understand how to receive jewelry for repair and document jewelry items.
- String pearls and beads.

- Identify the basic parts of a quartz watch.
- Change watch batteries.
- Repair eyeglass frames using the proper solders.

Project 4: Bezel-Set Onyx Ring

Make a bezel-set onyx ring.

By the end of this lesson, you'll be able to:

- Form a band from flat stock.
- Measure, form, and solder a bezel from bezel wire.
- Secure a stone in the bezel.

Stone Setting

In this lesson, you'll learn how to set stones.

By the end of this lesson, you'll be able to:

- Identify the tools and burns used for setting stones.
- Understand how a prong setting is made.
- Recognize the steps needed to make any kind of stone setting.
- Know the characteristics of an effective setting.

Jewelry Design

Explore the fascinating principles and elements of basic jewelry design.

By the end of this lesson, you'll be able to:

- Understand the parameters of jewelry design.
- Sketch your design ideas with paper and pencils.
- Recognize the aspects of three-dimensional objects.
- Know the types of settings and stones.

Graded Project 3: Three-Stone Prong-Set Band

Construct a three-stone prong-set band. Craft a ring band from any type of sterling silver or gold-filled or plumb gold stock. Then, attach three gemstones to the band using several four-prong settings.

Graded Project 4: Wedding Band Resizing

Resize two sterling silver bands—one is size 5 and one is size 7—to size 6.

Note: The titles of your learning materials may be different from those listed on your program outline. There is no need to call your instructor about these differences. While the titles of certain learning materials may differ, the educational content is the same. All learning materials are designed to give you the finest education in your field. If you need instructional assistance, however, be sure to call for help. We reserve the right to revise the program of study and the instructional materials and to substitute for the items of equipment offered.

Gesswein Catalog

<https://www.gesswein.com/t-gesswein-catalog.aspx>

History of Jewelry and a Summary of Metals



Lesson 1 Overview

Does the title of this study unit make it sound boring? If you think so, you'll soon find out how wrong you are. The information is relatively easy to understand and at the same time interesting.

The section on the history of jewelry is quite brief, giving you just enough information for you to see how old the profession you've chosen is, and how it all began and continued to the present.

The material on metals is critical to your studies. Most of the information you'll use every day, but in a practical way. Don't be concerned about memorizing specific facts and figures like the exact differences between grams and pennyweights. Every good jewelry supply catalog has a reference chart for that very reason.

Let's see just what you're going to learn in this unit. You'll begin with a brief overview of the history and development of jewelry arts through the ages. You'll discover that for thousands of years there have been very few changes in how jewelry is made and used. Historical highlights of special significance are presented to help you appreciate the roots of this art.

Because most jewelry is fashioned from metal, the bulk of this unit centers on that topic. You'll study how metals are used in making coins, industrial items, and finally jewelry. You'll become familiar with ways of mixing gold and silver with other metals to produce varying degrees of hardness and color. You'll study the effect of heating and cooling on jewelry metals as you learn how to make metals harder or softer.

The final part of the unit covers proper cleaning and finishing techniques, including filing, sanding, and polishing.

Take your time in this study unit. The concepts are important to your future career as a jewelry repair technician.

Lesson Objectives

When you complete this study unit, you'll be able to

- Define amuletic and social jewelry and explain their purposes
- Briefly describe the contribution of different cultures to the art of jewelry making
- Define the terms malleability and ductility and explain their importance
- Describe gold-mining processes
- Explain the process and purpose of alloying metals
- Explain the difference between 10kt., 14kt., 18kt., and 24kt. gold
- Describe the steps used to identify precious metals by acid testing
- Calculate the value of a gold item
- Explain the structure of gold-filled jewelry
- Describe the uses of silver, copper, brass, bronze, and platinum
- Explain the proper techniques for finishing, polishing, and cleaning jewelry
- Explain how to use plating solutions and finishing equipment safely

History of Jewelry

More people today than ever before are able to afford the luxury of jewelry. This makes your job of jewelry repair technician an important one. Becoming familiar with some of the history of jewelry will give you a better appreciation of the career you've chosen. Consider some of these historical facts about jewelry:

- Styles of jewelry and the materials of which it's made vary from culture to culture.
- Social orders, religious customs, and the availability of raw materials played a large part in the types of jewelry made.
- Everything from wood and clay to seashells and feathers has been used for personal adornment through the ages.

This material on the history of jewelry should give you a good perspective on the role jewelry played in various cultures.

Jewelry as Protection

Since the beginning of time, people have tried to control their fate or destiny by assigning special powers to all types of objects. They carried some of these objects around with them—objects such as stones and small images crafted of wood or clay. Often they attached these articles to a piece of leather or vine so they could wear them around their necks or wrists. Even though they weren't worn for the purpose of decoration, these objects were a type of jewelry. Such jewelry, worn because of its "special powers," is called *amuletic jewelry*.



FIGURE 1—These amulets were worn by ancient Egyptians for protection against evil. (Photo courtesy of William D. Reidsema)

Figure 1 shows three amuletic objects used in Egypt thousands of years ago. All three objects were worn around the neck to protect the wearer from evil. The scarab, shown in the center, is actually a dung beetle, a common insect in the arid climate of Egypt. After the dung beetle lays its eggs in the dry sand, it dies. Since the eggs require the moisture of rain to hatch, many years may pass before the tiny insects emerge. When the rains do come, the new beetles emerge by the thousands, covering the desert floor. Because early

Egyptians believed this occurrence to be magical, they assigned to the scarab, or dung beetle, special power over life. The scarab is still used in jewelry today.

The pendant on the left represents the Egyptian goddess Hathor, the cow goddess; the one on the right is a shawabti, a small human form used for protection. A shawabti was often buried with the dead to be a servant in the afterlife.

Today similar jewelry is available in the form of crystals that some believe contain special energy. Others wear religious medals to protect themselves. In fact, jewelry can tell a great deal about the people who wear it or about their culture. Today people identify themselves with their beliefs by wearing different styles of crosses, crystals, gemstones, and occult symbols. Movies and cartoons often depict the power of amuletic jewelry, as do many books. For example, the plot of J. R. R. Tolkien's trilogy *The Lord of the Rings* involves a ring believed to hold special powers. Even though we consider ourselves to be an advanced technological society, things have changed very little in regard to superstition and people's hopes of controlling their future. Let's look at a few common gemstones worn today, along with the special meanings and powers that people have attributed to them for the past hundreds to thousands of years.

- **Amethyst.** According to legend, amethyst originated when the god of wine, Bacchus, became angry with mortals. He vowed that the next mortal he saw would be eaten by tigers. After his decree, a young maiden, Amethyst, was on her way to worship the goddess Diana. Diana, aware of Bacchus's decree, turned Amethyst into a pillar of clear quartz to protect her from the tigers. Bacchus then poured wine over Amethyst, staining her purple. People have believed for centuries that drinking wine from an amethyst cup prevents drunkenness.
- **Opal.** Ancient Romans believed that opals had fallen from heaven during flashes of lightning. Opals were the symbol of hope and purity for them.
- **Ruby.** People thought rubies brought success, health, and wisdom in love to those who wore them.

These and other superstitions have helped jewelry develop into objects of value.

Jewelry to Designate Rank and Authority

Whether it's in relation to destiny (amuletic jewelry) or social order (social jewelry), power is often the driving force of society. The struggle for power creates many customs that make their way into society.

Social jewelry was developed through the social orders of many cultures in which jewelry was worn to designate rank or authority among its members. But the underlying principle of both amuletic and social jewelry is the same—power.



FIGURE 2—The crown jewels of Britain are a symbol of power and authority for those who are privileged to wear them.

The most noted examples of social jewelry are the crown jewels of the most recent empire of Britain (Figure 2). As a country or an organization develops wealth beyond measure, it rarely shares this wealth with the less fortunate of its group. Rather, it lavishes the wealth on its leaders. A crown or staff of jewels denotes the ultimate authority of those who wear them. In the last 20 years, the countries of the oil-rich Arabian nations and the technological fortunes of Japan have created much wealth for these cultures. Today these two countries dominate the world market as buyers of rare and valuable gemstones and jewelry.

Jewelry is often given to individuals as a reward for some accomplishment. Consider these examples:

- Medals of distinguished service and honor are presented in many military organizations and may also be used to denote rank and authority among their members.
- The American Bowling Society awards a valuable ring as a medal to members who bowl a perfect game.
- Each member of the winning Super Bowl team receives a ring as a symbol of victory.

These are just a few instances of jewelry as a symbol of accomplishment that often identifies the wearer with a special event.

Nothing New

Archeologists have unearthed jewelry dating back to 3000 B.C. Some of these pieces are very similar to the rings, earrings, and necklaces fashioned today. The Sumerians of that age are credited with casting, soldering, and forming fine works of gold jewelry. They also began the art of granulation, which was perfected around 700 B.C. by the Etruscans.

Granulation is the process of covering the surface of metal with tiny gold balls. Because this technique is so difficult to perform, usually only accomplished jewelers attempt it today. (You'll learn more about the art of granulation later in this program.)

The name Etruscan is now applied to a style of jewelry making a comeback today, almost 2600 years later. Other styles popular today are reproductions of Greek and Roman designs. Although history isn't everyone's first choice of study, you'll find many design ideas from different periods of the past. These styles are still popular thousands of years later because they're appealing designs. In fact, many top jewelry designers and manufacturers today produce the same styles as ancient civilizations because few new designs can compare to those created centuries ago.

Antique and Estate Jewelry

Chances are you'll never have to repair a piece of jewelry thousands of years old because these pieces are in museums and don't get much wear. What you *will* encounter are many pieces of antique and estate jewelry. *Antique jewelry* is considered valuable because of its age. *Estate jewelry* is previously owned jewelry that may or may not be old enough to be considered antique.

Quality antique jewelry is in very high demand because of its rarity and age. Much of the quality older jewelry is superior in craftsmanship to the mass-produced jewelry of today. Even if a jeweler were capable of producing these long-lost standards of excellence, few people could afford to pay for the time and effort needed to make jewelry as precise and as delicate as some antique pieces.



FIGURE 3—This antique jewelry shows the fine detail work called filigree, which was popular during the first part of the twentieth century. (Photo courtesy of William D. Reidsema)

Some believe that American craftsmanship has been on a steady decline since the late 1950s and early 1960s. As art became freer and less structured, true artists were no longer called upon to pass down their skills to the next generation. Thus, techniques such

as those used to produce fine filigree jewelry were lost from one generation to the next (Figure 3).

You'll typically be asked to size rings, replace shanks, and repair prongs on rings that were made in the late 1800s and early 1900s. During these years, up until the 1929 stock market crash, North and South America and parts of Europe were experiencing a great time of prosperity. With the opening of British-controlled diamond mines in South Africa, the supply was available to meet the needs of the rising economies. More money meant more luxuries, and the jewelry industry was taken to new heights by names such as Fabergé and Tiffany.

Practice: History of Jewelry

<https://courses.portal2learn.com/d2l/common/dialogs/quickLink/quickLink.d2l?ou=16900&type=quiz&rCode=c6d13a79463f4dcc06c97c3-1>

Metals

Characteristics of Metals

Bench jewelers might easily be called metalsmiths since they do work in metal. Let's look at some of the characteristics of metals that jewelers commonly work with which distinguish them from other common metals.

One common characteristic of jewelers' metals is their ability to conduct electricity, which is one reason why people in industry are often required to remove all jewelry at the workplace. As a jewelry technician, you must simply be aware of this characteristic for safety reasons. Serious accidents have occurred because of a metal's conductivity. For example, a safety chain attached to a woman's bracelet somehow dropped into an electrical outlet while she was wearing it. She received a terrible shock and a burn up to her elbow due to the excellent conductivity of the gold in the bracelet. Being aware of this characteristic can help you avoid unusual accidents.

Metals used in jewelry also have the ability to reflect light. Light reflection helps to make jewelry attractive since it causes the metal to shine. You should learn to properly polish a piece of jewelry to its greatest luster so it will reflect the most light possible.

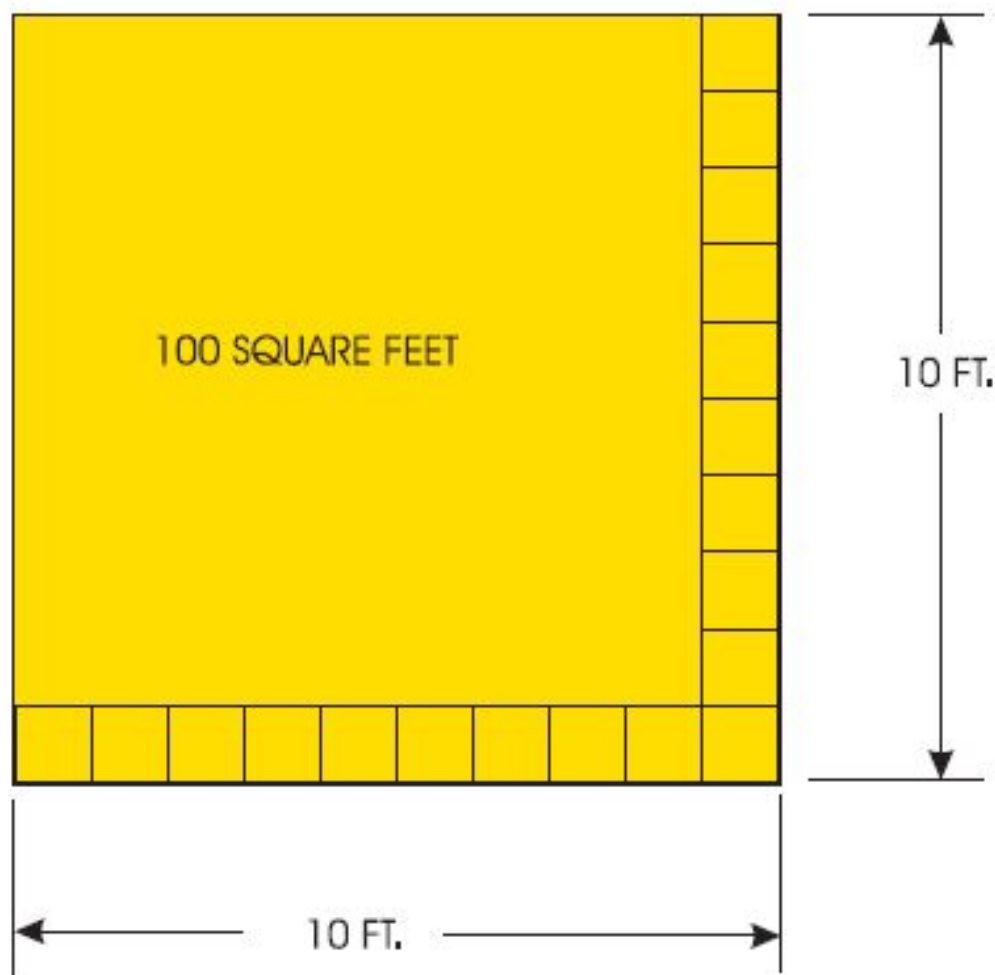


FIGURE 4—Gold is so malleable that one ounce can be rolled into a sheet of 100 square feet. This illustration shows a sheet 10 feet by 10 feet, or 100 square feet.

Two primary characteristics of metals that are of concern to jewelers are malleability and ductility. *Malleability* refers to the ability of a metal to be hammered or rolled into sheets. Gold is the most malleable of all the metals, but silver is very malleable as well. For example, one ounce of gold (approximately the size of a half dollar) can be formed into a flat sheet of 100 square feet (Figure 4).

Sign makers use gold and silver leaf, which are pieces of the metals hammered into sheets thinner than a piece of paper. The sheets are so light that artists don't even touch them with their hands. Rather, they blow the sheets from their wrappers to the sign they're making. Since gold and silver are malleable, they can be hammered and worked into

many shapes without becoming brittle. They are therefore extremely appropriate for jewelry work.

Though not commonly used in jewelry, aluminum is very malleable, which is evident from its use as household aluminum foil. Copper is also malleable and used in sheets and foils.

Ductility is the ability of a metal to be drawn into wire without breaking, while still maintaining its flexibility. Two of the most ductile metals are silver and gold, which can be drawn into wire thinner than a human hair. Wire this thin is used in some electronic industries, since gold and silver are such good conductors of electricity. To give you an idea of its ductility, one ounce of gold can be drawn into a wire over one mile long.

Another consideration in choosing metals for jewelry is their ability to resist *oxidation*, the breaking down of a metal when it's exposed to air, fire, or chemicals. Both silver and gold have little reaction to oxygen in the air, nor even to most acids.

Gold and silver are rated high in the properties of malleability, ductility, and their resistance to oxidation—which makes them the best choices for jewelry making.

Metals Used in Coins



FIGURE 5—These ancient coins date from 450 A.D. back to 450 B.C. The oldest (top center) is actually the best looking. It shows a likeness of King Philip II of Macedonia from around 450 B.C. (Photo courtesy of William D. Reidsema)

Gold, silver, and copper have been used for making coins for thousands of years. Figure 5 shows ancient coins that date back as far as 450 B.C. Notice the great detail in the faces of the rulers they represent. Gold coins were still in common use in many countries until the 1930s, and silver wasn't removed from coinage in the United States until 1965. As units of tradeable value, gold and silver have always had a place in society. Gold is still used to back up the value of paper money in most countries.



FIGURE 6—These current United States coins show the edges that were added to prevent people from filing off small amounts of the valuable metals.

Notice that the ancient coins in Figure 5 don't have a round coin edge like our coins today (Figure 6). The coin edge was developed during the late Roman period. Before the coins were edged, people would often file a small amount of the precious metal away from the coin and save it. This filing made the coins lighter and reduced their real value. Merchants finally started charging more for products because they were receiving "light" coins. Adding a band of edging, or coin edge, made it impossible to remove metal without wearing away the band. If the band was filed away, the coin wasn't acceptable since it was no longer worth its face value.

Practice: Metals

<https://courses.portal2learn.com/d2l/common/dialogs/quickLink/quickLink.d2l?ou=16900&type=quiz&rCode=c6d13a79463f4dcc06c97c3-2>

Gold

What Makes Gold So Valuable?



FIGURE 7—This teaspoon of gold is worth more than the average person's wages for one week. (Photo courtesy of William D. Reidsema)

A teaspoon of pure gold is worth more than an average person's wages for one week (Figure 7). Why is this so? People were first captured by the beauty of the metal and soon realized that it was in scarce supply. These two factors more than any others have

contributed to the high value of gold. The value of anything, however, is what someone is willing to pay for it. Gold has had a trading value from the day it was first discovered.

Mining Gold

Gold was most likely first discovered in the gravel beds of streams. Today it's still removed from streams by panning and sluice mining. *Panning* is the age-old method of swirling sand and gravel in a pan of water. As the water moves most of the sand and gravel over the edge of the pan, the heavier gold sinks to the bottom of the pan and is saved. *Sluice mining* is based on the same principle as panning. It uses long troughs (sluice pipes) through which water is channeled. The sand and water travel through the pipes, but once again the heavier particles, including the gold, fall to the bottom and are caught in slats in the bottom of the sluice. Sluice mining is used by small mining operations with only one or a few people. Larger companies have heavy machinery for dredging gold-laden sand and gravel from the bottoms of rivers.

Pearls of Wisdom: The California Gold Rush

In 1847, when gold was first discovered at Sutter's Mill, California, men from all over the globe traveled to that area hoping to "strike it rich." Over 35,000 people ventured to California over the next twelve years with hope of finding enough gold to fulfill their financial dreams. The great gold rush ended in disappointment for most, and thousands continued in poverty and hard conditions on the western frontier. The name "gold fever" was given to the excitement that had developed for gold, often clouding people's judgment and common sense. Other great rushes of the recent past include one in the Klondike region of British Columbia in 1896 and the Alaskan gold rush of 1898.

Vein mining is the process of digging in the earth for gold deposits. To recover only one ounce of gold from a vein, almost 1,000 pounds of ore must be processed by crushing it with large machinery. More than one-half of all gold produced is obtained through vein mining. Another third of the world's gold production is obtained as a by-product of zinc, lead, and copper production.

Most of the world's gold today comes from mines in South Africa, Australia, North America, and most recently, Russia. Most of this gold is used as currency reserve. After World War I, heavy inflation hit many countries and disrupted the gold standard system which was set up internationally. Gold was then removed from currencies and substituted with paper money.

Karat or Carat?

Although both these terms are used in the jewelry business, they have completely different meanings. A *karat* is a unit of measurement that applies to the purity of gold. A *carat* is a measurement used in weighing gemstones. Don't confuse the two.

Alloying and Karating

Alloying is the mixing of one metal with a second metal to produce a third metal. An alloy is a metal that can be melted and added to another metal to change the characteristics of the original metal. An alloy is often added to pure gold for two reasons:

1. Since gold is a very soft metal, it's often alloyed to give it durability and strength. When copper, the primary alloy, is added to gold, the gold becomes much harder and more resistant to wear.

2. Some alloys, such as palladium, are added to gold to change its color to white. (Green and red colors are achieved by adding different combinations of various alloying metals.)

The American standard for identifying gold purity is karating. A *karat* is a unit of measurement that applies to the purity of gold. The abbreviation for karat is *kt*.

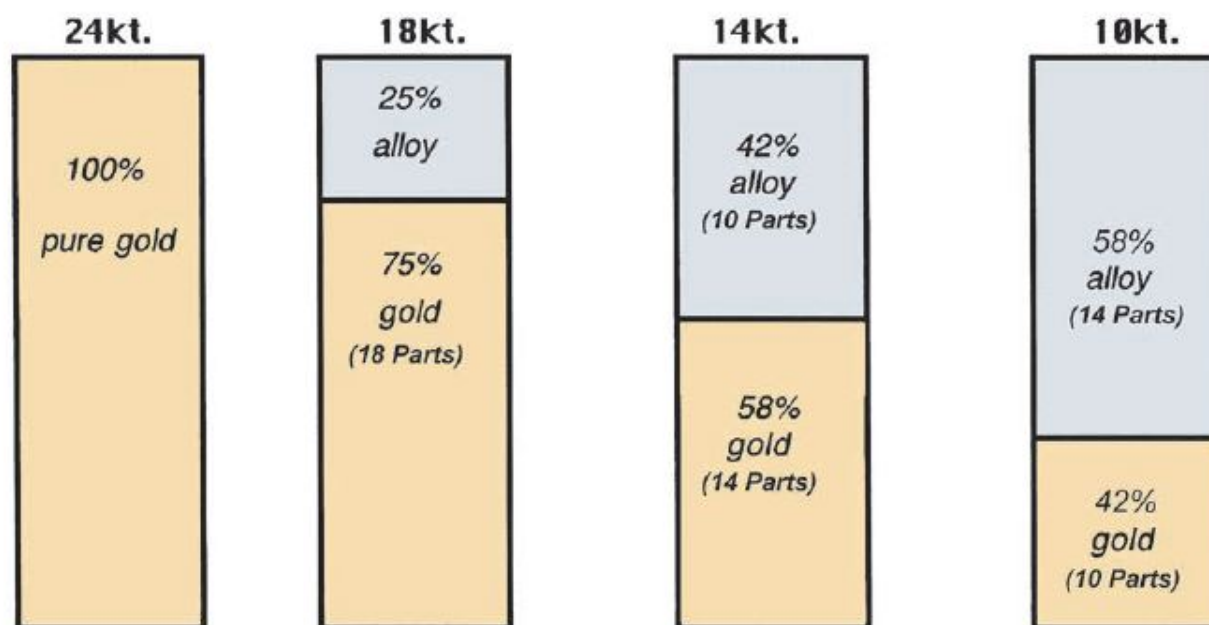


FIGURE 8—These bars illustrate how alloys are mixed with pure gold to obtain different levels of purity.

Karating is based on 24 units, or parts. Look at the gold bars in Figure 8. The 24kt. bar illustrates pure gold. Nothing has been mixed, or alloyed, with it—so it's 100% gold. The 18kt. gold bar is made of 18 parts pure gold and 6 parts alloy. The 6 parts alloy lower the purity of the gold, but also make it harder and more durable.

The 14kt. gold bar is 14 parts gold and 10 parts alloy. It's only a little more than half gold and almost half alloy. Finally, the 10kt. gold bar is the reverse of the 14kt. bar, being less

than half gold and primarily alloy. Gold articles are stamped as 10kt., 14kt., 18kt., and 24 kt., depending on their purity.

In Europe and many other countries, gold is marked according to the percent of pure gold it contains in thousandths. For example, gold manufactured in Italy, which is commonly sold in the North American marketplace, may be stamped .585 or .750. These numbers refer to the decimal percents of pure gold in the item. The rating .585 is the rounded decimal used for 14 kt. A rating of .750 is the same as 18kt. In many ways, the European system makes much more sense and is easier to use than karating because it's based on decimals—something most people are familiar with.

Over the years, different refiners of gold have used their own combinations of alloys, which have resulted in different colors of gold. (Basically, a *refiner* is a person who has the equipment to melt down metal alloys and extract the pure metals.) One refiner's 14kt. yellow gold often had very slight differences in color from that of another refiner. In 1989, the Manufacturing Jewelers and Silversmiths of America began working on a gold color standard that helps to provide consistency in the colors used in jewelry of 10kt., 14kt., and 18kt. gold. They've come up with a numbering system for the four colors of gold used most often: red, green, yellow, and white. According to this system, 14kt. yellow gold from refiner or supplier A should be the same color as that from refiner or supplier B. In Canada, the color of gold is determined by *percentage of alloy*, not by a numbering system.

Why is it so important that the color of gold be consistent from one supplier to another? Consider this example. Suppose you have to add a piece of gold to size a ring. The color of the added gold should match the gold in the ring. Even though you might be adding the same quality of gold to the ring, if the color doesn't match, you can notice the difference. Customers don't want their rings with two different colors, even if it's only a slight shade of difference. They may jump to the conclusion that you've used a lower quality material to size their ring. Some people may even think you've used something other than gold to size or fix their ring, because they assume that all gold is the same color.

Be very careful when taking in jewelry for repair. Many rings aren't *quality stamped*—that is, there's no indication of the quality of gold they contain. If the ring is old, matching the color of the gold may be impossible. Explain this to your customers when examining their jewelry for repair. People appreciate the fact that you share your knowledge with them, and it gives them confidence that you know what you're doing.

Try to offer information in simple terms without getting into too much technical detail. Most people are interested in gold, gemstones, and jewelry, but have little real understanding of them. Whenever you can sincerely offer a bit of information to educate your customers, they'll appreciate it.

Pearls of Wisdom: Federal Regulations

In 1976, the United States government passed a law, to be regulated by the Federal Trade Commission, to insure standards in the jewelry industry. A piece of gold jewelry labeled KP (karat plumb) must meet the following purity standards established by this law:

All gold jewelry that doesn't contain solder must be accurately labeled within 3 parts per thousand of its label.

All gold jewelry containing solder must be accurate to within 7 parts per thousand. Unfortunately, a gold-stamping device is available to anyone for under \$20.00 and can be used to imprint a 14KP stamp on anything from an old spoon to your Aunt Millie's toaster. Never purchase gold without knowing the supplier or performing an acid test on the article. Many people have been fooled by jewelry made of brass alloy but marked as gold.

Gold-filled Jewelry

Gold-filled jewelry is made of a base metal, usually copper, to which is bonded a thin layer of karat gold sheet. The process for making gold-filled jewelry was developed in the early part of the twentieth century, but it's still made in small quantities today. The overlay of gold can be 10kt., 12kt., or even 14 kt. It gives the outer layer of the jewelry a durable, true gold finish. The cost of a gold-filled item is less than a solid gold piece because less gold is used to make it. Gold-filled items still common today are locket, bangle bracelets, and identification bracelets. An item stamped $\frac{1}{20}$ 12 KGF means that one twentieth of the weight of the jewelry is 12kt. gold. The rest is base metal.

You can solder gold-filled jewelry just like normal karat gold jewelry, but you must polish it carefully so that you don't remove the top layer of gold and reveal the copper alloy underneath. If an item isn't quality-stamped, you can determine if it's gold-filled by looking for wear spots along its edges and where the links of a chain rub against one another. This saves the time of an acid test and provides a quick identification.

Assaying

Assaying is the process of analyzing a sample piece of metal to determine the amount of precious metal it contains. A jeweler often sends to a refiner polishing dust and filings from his or her bench. The refiner assays the material to determine its value. Assaying is the only way to accurately tell what a bag full of polishing dust is worth. One process used by refiners involves immersing the materials to be assayed in baths of dangerous chemicals such as cyanide and aqua regia. (*Aqua regia* is a solution of one part nitric acid and three to four parts hydrochloric acid.) The solution is a very dangerous substance, but it's the most effective way to assay and refine gold. Few jewelers do their own refining because of the dangers and special equipment needed.

How can you know if an article of jewelry is gold—and what karat gold—without sending it to be assayed? There are two basic ways you can test articles in the shop. Electronic gold testers, which appeared on the market in the last few years, are simple to use. Unfortunately, they're also quite expensive.

Most jewelers use a simple acid-testing process. As mentioned earlier, gold is resistant to oxidation. It's also resistant to most acids. Alloys, however, aren't resistant to acids and dissolve immediately. Nitric acid does dissolve gold, but at a slow rate. The basis for acid testing is the rate at which gold and alloy are affected by nitric acid. Various strengths of testing acid are used for testing different karats of gold.

WARNING!!!

Acids used for testing gold and silver content in jewelry are highly concentrated and can cause severe burns. If they can dissolve metals,

they'll certainly cause severe burns upon contact with skin. Use extreme caution when using these acids and always keep them in a locked cabinet away from children.



FIGURE 9—To perform an acid test, you need testing solution, a test stone, and gold stock. (Photo courtesy of William D. Reidsema)

Figure 9 shows the materials needed for an acid test: plastic bottles of testing solution for both 14kt. and 18kt. gold, a test stone, and pieces of gold stock of a known value. As an example, let's test a ring believed to be 14kt. yellow gold.

To perform an acid test, proceed as follows:

1. Using a piece of stock (wire, sizing material, or other item) that you know is 14kt. gold, scratch a line on the test stone.
2. Scratch a second line with the ring to be tested. Always scratch on the least noticeable area of a ring or other piece of jewelry because the scratch leaves a small mark on the item. In this case, scratch the edge of the shank of the ring so it can be polished out.

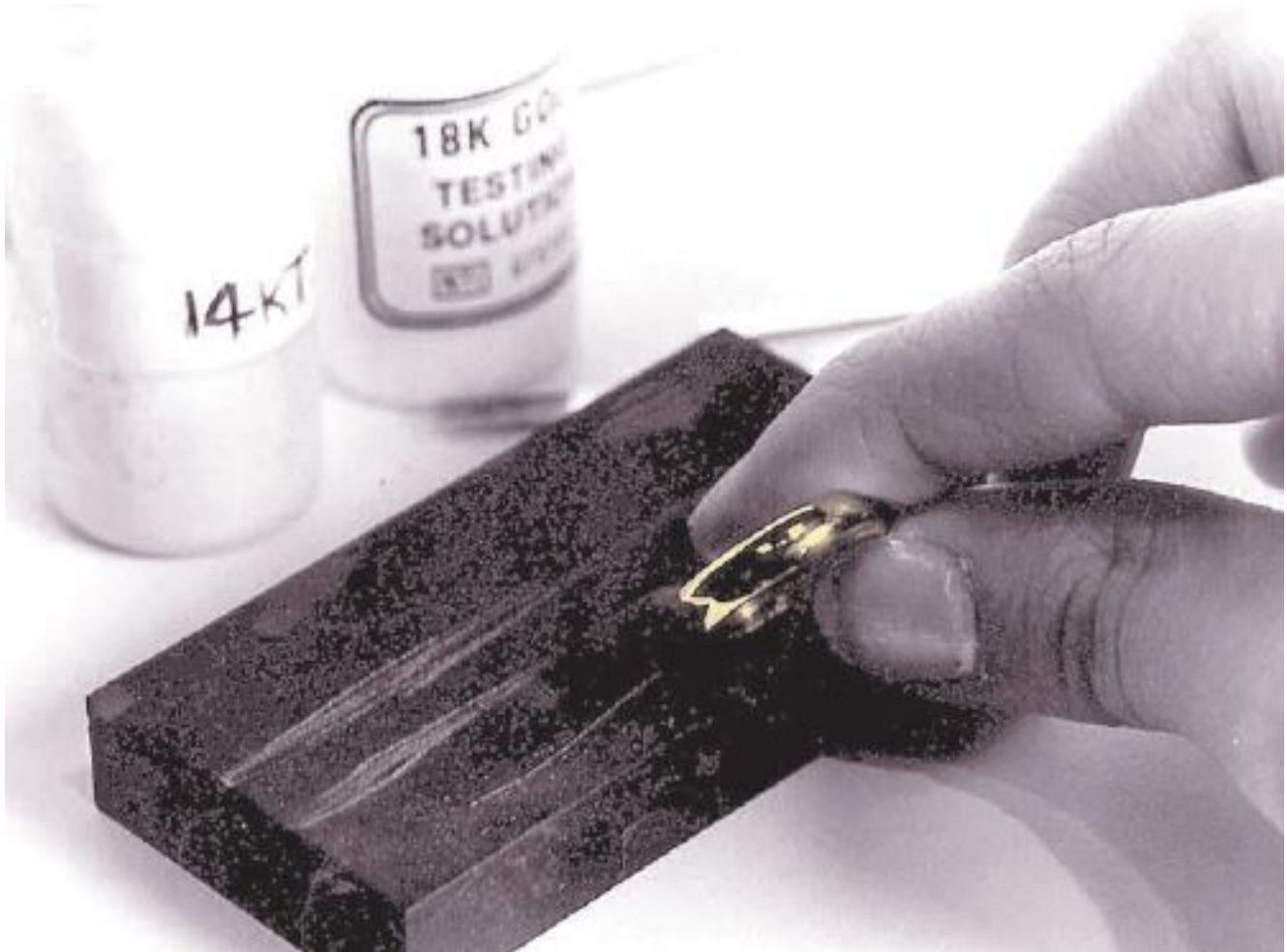


FIGURE 10—The jeweler scratches three lines on the test stone: one with an object known to be of a certain karat gold and the other two with the object being tested. (Photo courtesy of William D. Reidsema)

3. Scratch a second line with the ring (Figure 10). Why make two lines? If the object being tested is gold-filled, the first sample from the outside layer is gold, and will test as gold. Since the first scratch line removed any outer layers, the second test line should be made of the metal under that surface layer.

You now have three lines on the test stone. The top line you know to be 14kt. gold; the bottom two are the ones you're testing—the ones made with the ring.

4. Apply one drop of the 14kt. acid testing solution to the stone and smear it across the center of all three lines.



FIGURE 11—The two lower scratches have been made by jewelry which isn't real gold. Acid has "erased" the center of each scratch. (Photo courtesy of William D. Reidsema)

Figure 11 shows what happens when the article you've tested is *not* gold. The metal in the places touched by the acid has dissolved, but the real gold in the top line isn't affected. The alloy in the bottom two lines couldn't stand the corrosive acid and was melted away.



FIGURE 12—When the jewelry being tested is real gold, the acid won't affect it. (Photo courtesy of William D. Reidsema)

Figure 12 shows what happens when the article you've tested is real gold. As you can see, the three scratched lines are still there. At first glance it may only seem that the article tested is gold. You need to watch the acid work for 15–30 seconds. If nothing happens in 30 seconds, you can assume the metal tested is 14kt. (the same as the testing acid). However, if the two test lines start to fade away faster than the line known to be 14kt., then

the test piece contains less gold than 14kt. If after 60 seconds the line known to be 14kt. begins to fade and the two test lines don't, then the test piece contains more gold than 14kt. If this occurs, test the article against 18kt. stock and acid.

By using this inexpensive acid test, you can tell whether an object is gold or not, and you can very closely determine the actual karat gold of the object. Complete gold testing kits contain a test stone, acids for testing 10kt., 14kt., and 18kt. gold, and a set of nine different needles tipped with different karats of gold. These materials come in a small wooden box and run as much as \$75. It's more economical to buy one or two bottles of acids and a separate test stone— all for under \$20. You can use your own gold known to be of the karat you want to test. The results of your tests won't be perfect, but they'll be very close.

Determining the Value of Gold

The value of gold or jewelry, as well as any other article, is what someone is willing to pay for it on a given day. Gold is a *liquid asset*, which means there's always someone who will pay you very close to the market value at any given time. A car or home isn't considered liquid, because it may take months, even years, for you to find a buyer who will pay the price you expect.

The price of gold varies daily due to changing financial conditions in the world. The business sections of large newspapers list the price of gold for the preceding day. You may find it interesting to follow the price of gold in your newspaper for a week or a month.

To calculate the value of a gold item, you must know (1) the weight of the item, (2) the karat value, and (3) the current price of gold.

Precious metals are weighed in troy ounces. The *troy ounce* is a unit of measurement in the Troy system of units and measures developed in France in the fifteenth century. Even though this system has been replaced by other systems for most applications, it has been maintained for use with precious metals.

A troy ounce is divided into 20 parts called *pennyweights*. The word pennyweight is generally used in its abbreviated form, dwt. The dwt. is the unit of measure used when gold is purchased in quantities under one ounce. The gram is a unit of measure which has long been used in Europe and other parts of the world.

Let's calculate the value of the gold ring we just tested using the following procedure:



FIGURE 13—Small electronic scales are used to weigh items in grams, pennyweights, and ounces. (Photo courtesy of William D. Reidsema)

1. Using a small electronic scale (Figure 13), weigh the ring. To do this, first set the scale so that it weighs in pennyweights, as indicated by the small dark arrow at the right-hand side of the display screen. The scale in Figure 13 indicates that the ring weighs 2.3 dwt.
2. Assume that the current daily price of gold is \$375 per ounce. Divide this amount by 20 to find the value of one pennyweight. (Remember: There are 20 pennyweights in one troy ounce.) The answer is \$18.75, which means that one pennyweight (1 dwt.) of pure 24kt. gold is selling around the world that day for \$18.75.

3. Since the ring you tested is 14kt. gold, only $\frac{14}{24}$ of the ring is pure gold. To find the value of 1 dwt. of 14kt. gold, multiply \$18.75 by $\frac{14}{24}$. When you multiply, use the rounded decimal equivalent for this fraction, .585. Now multiply:
- $$18.75 \times .585 = 10.96875$$

We then round to two decimal places. The current price of 1 dwt. of 14kt. gold is \$10.97.

4. To find the value of the ring, multiply its weight (2.3) by the value of 1 dwt. (\$10.97):

$$2.3 \times 10.97 = 25.231$$

We then round to two decimal places. The value of the gold in the ring is \$25.23.

If the ring in question contains gemstones, they must be accounted for with different formulas which will be covered later in this course.

Another common type of weight used in measuring gold and silver is a metric unit mentioned previously—the *gram*. A gram weighs less than a pennyweight. There are 31.104 grams in a troy ounce, but only 20 pennyweights. Therefore, to calculate the cost of one gram of gold, divide the daily gold rate per ounce by 31.104. For example, if the daily rate is \$375 per ounce, the cost per gram is

$$\frac{375}{31.104} = 12.05632716049$$

Let's round that decimal to two places! The cost per gram is \$12.06.

Once you begin to work with pennyweights and grams, they'll seem less confusing than they do right now. Practice determining the price of gold in dwts. until you feel comfortable with that weight; then move on to grams. Both measurements are used in the jewelry industry, but the gram is more often used in the measurement of gold and silver chains.

Would you rather pay \$10 a gram for a 14kt. gold rope chain or \$15.55 a pennyweight? Even though the price per gram sounds like a better deal, they're both virtually the same. To prove this, let's find the price per ounce at each rate. There are 31.104 grams per ounce; therefore, the price of one ounce at \$10 per gram is

$$31.104 \times \$10 = \$311.04$$

There are 20 pennyweights per ounce; therefore, the price of one ounce at \$15.55 per pennyweight is

$$20 \times \$15.55 = \$311$$

The price per ounce is practically the same at each rate. As you can see, weights and measures can be tricky. Become familiar with calculating prices of gold. You want to be fair to your customers, and you want to be sure you're paying and getting a fair price for the gold you're purchasing and selling.

What Should You Pay for Gold?

Let's go back to the ring we tested and priced. Suppose a customer comes into your shop and wants to sell you that ring. What should you reasonably pay for it?

You look at the ring and decide that you probably won't be able to sell it. The ring is old, and its style is outdated. The only value the ring has to you is as scrap—that is, its gold content. It's more practical to sell the ring to a refiner and reclaim its dollar value in gold than to let it collect dust in the display case.

First you must make allowance for the refiner's fee, which is at least 10 percent in quantities under 100 dwts. This amount may seem high, but it's better to estimate high than to lose money in the end. The 10 percent includes the refiner's fee and the gold lost in the refining process. You've already calculated the price of the ring as \$25.23. Deducting 10 percent from this amount results in \$22.71.

Since you must make a profit to stay in business, you must also deduct that amount from the price of the ring. You were working at your jeweler's bench when this customer came in. Your productive work, which customers are paying you to perform, has been interrupted; you've taken time to talk to the seller, examine the ring, test and weigh the ring, and determine the value of its gold content. Assume that all this has taken 10 to 15 minutes. Since your time at the bench should be producing a minimum profit of \$20 per hour, then you should plan to pay at least \$5 to \$10 less for the ring. Let's use a middle figure of \$7.50 to cover your time. Deduct this amount from the already reduced price:

$$22.71 - 7.50 = \$15.21$$

You can't pay more than \$15.21 for the ring and still make a reasonable profit.

The profit amount in this example is just an estimate. You may wish to make more or less profit, depending on your circumstances, but the same type of calculations are involved.

What Is Scrap?

A piece of jewelry is considered *scrap* if it's worth more to you when it's sent to the refiner's and returned to a gold piece. Usually, scrap jewelry is something that will never sell. Examples are old worn rings that have no antique or estate value and worn or broken chains.

Practice: Gold

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Silver and Other Metals

Silver

Silver is second only to gold for its use in jewelry. The shiny white metal is popular both for its appearance and its low price compared to gold. Silver is a better conductor of heat and electricity than any other metal. Next to gold, silver is the most malleable and ductile metal known. For centuries it was used primarily as coinage, but today the bulk of silver is used for photographic purposes. Only 10% of the silver mined today is used in making jewelry.

Silver alloyed with 7.5% copper is called *sterling silver*. Adding this small amount of copper makes the silver much harder. Sterling silver is suitable for making bowls, platters, flatware, and other items in which the soft, pure silver would be easily dented or bent from its original form. The drawback to sterling silver is that the added copper causes the silver to oxidize and tarnish more easily.

Higher-quality silver jewelry is plated with rhodium after it's polished and cleaned.

Rhodium is a relatively rare white metal that costs more per ounce than gold. It's very hard and doesn't easily oxidize or discolor. Rhodium is used to keep the outer surface of silver jewelry a bright white that won't tarnish.

Problems occur quickly when rhodium-plated sterling silver must be soldered. The heat from general soldering melts the rhodium into small beads that fuse themselves to the surface of the sterling silver. These beads are very difficult to remove, and polishing the piece becomes a chore. Rhodium-plated pieces are very hard to spot; even experienced jewelers regularly fall into the trap of soldering a piece of rhodium-plated silver and must suffer the consequences.

When working on silver jewelry, remember that it's the best conductor of heat. The heat from a jeweler's torch travels quickly to any stones in the ring. Most stones, especially turquoise, can't tolerate the intense heat and will be ruined unless they're removed before soldering begins. Jewelry with inlays, a mixture of epoxy and crushed stone, should never be soldered. The intense heat will cause the inlay to come apart.

Silver is resistant to most acids but is affected by nitric acids used in gold-testing solutions. Silver items bubble and turn green in the area where acid is applied. Separate acids, usually hydrochloric, are available for testing sterling silver.

German silver, or nickel silver, is a nickel alloy that contains no actual silver at all, but its appearance is very similar to sterling silver.

Copper

Copper is an abundant metal used in some costume and handcrafted jewelry. Because it's inexpensive and is used commonly for a multitude of purposes in our society, copper isn't used in making jewelry of any great value. Although it's used effectively by itself and in combination with silver to produce some attractive jewelry, the actual or perceived value is much lower than that of silver or gold jewelry.

Brass and Bronze

When copper and zinc are alloyed, they produce a much harder metal— *brass*. Special alloys of brass are used in making costume jewelry because the color and working characteristics of brass are very close to those of gold.

Brass samples are used in the jewelry industry as samples for sales representatives. First a certain design of jewelry is cast in brass and then plated with gold. The result is a representative piece of jewelry that looks like gold but is a lot less expensive.

The metal you'll be working with in this course is a brass alloy that looks just like gold when polished. The jewelry you create as practice pieces will look like gold when they're finished.

Bronze is an alloy of copper and tin. It's used occasionally for casting belt buckles but rarely in making jewelry.

Platinum

Platinum is in the same family of rare metals as rhodium and also costs more per ounce than gold. Platinum is a white metal used in the manufacture of rings and findings for jewelry. A *finding* is a part, such as the head of a ring, which would incorporate the prongs that hold the stone. Platinum, though more expensive, is a better material for prongs than gold because it can last as much as ten times longer than gold. Platinum is often mixed with 18kt. yellow gold for a two-tone effect of white and yellow colors.

Platinum was widely used for rings and jewelry in the early part of the twentieth century. During and after the Depression, however, platinum was too expensive for most people. Only the very wealthy could afford it. Today platinum is making a big comeback in the jewelry industry and is being heavily promoted.

There are two reasons that platinum jewelry is more expensive than gold:

1. When platinum is used to make jewelry, it's alloyed 10% with metals such as iridium and other rare white elements. These are very expensive. When gold is used, it's alloyed with metals of less value, such as copper. Remember, 14kt. gold is only a little more than half gold. If a piece of jewelry were made from 24kt. gold, its price would be comparable to the same piece made in platinum.
2. A piece of jewelry with pure platinum is much heavier than a ka-rated gold piece and therefore requires more weight of metal to construct.

Platinum jewelry is therefore a *high-end*, or more expensive type of jewelry, handled in stores that cater to affluent clients.

Platinum melts at over 2000 degrees Fahrenheit, which is a much higher temperature than the melting point of gold or silver. Therefore, it's a more difficult metal to work with. Jewelers soldering platinum should wear eye protection to guard from the intense glow of the flame and metal. Special equipment is needed for casting platinum, so many jewelers use the services of casting houses which contract to do casting.

Practice: Silver and Other Metals

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Metal Finishing

A completed piece of jewelry must be finished and polished to achieve the desired effect. It may seem as if we're putting the cart before the horse, since polishing and cleaning are the last stages in the jewelry-making process; but from the beginning of every project, you must understand the type of finish you're trying to create. A person skilled in the area of polishing and finishing is just as valuable in manufacturing as a master diamond setter. In the final finish and polish stages, the metal used to create the piece is enhanced to its greatest beauty.

Finishing jewelry is like applying wax to a car to make it clean and shiny. If you polish only one fender and leave streaks of wax all over the hood and windows, you've done a poor job and have added little or nothing to the beauty of the car. Similarly, if a completed ring still has small scratches and dirty polishing compound left behind from finishing, it hasn't been brought up to its full potential.

After jewelry is handled or allowed to sit in a display case for a period of time, it loses its bright finish and is referred to as *case worn*. Even though the jewelry has never been worn, it needs to be repolished and cleaned to bring it back to its "new" condition and make it more saleable.

To fully understand polishing, you should look at a few more areas of *metallurgy*, which, simply put, is the science of metals. Don't worry, the basic principles of metallurgy as they apply to making jewelry are rather simple. Every large manufacturer of the gold, silver, and platinum alloys used in jewelry has its own chemists and metallurgists to do the complicated metal work. All you must know are some simple things about what happens to metal when it's heated, cooled, and hammered.

Working Metals

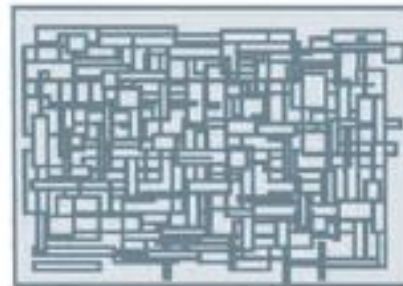


FIGURE 14—The figure on the left illustrates the crystalline structure of a piece of metal. The figure on the right is the same piece of metal after it's been hammered, or worked. Notice that the crystals are much closer together.

When metals are heated enough, they turn into a liquid. When the liquid is cooled, it returns to a solid. Consider what happens to an ice cube: when it's heated, it changes to a liquid. When it's cooled enough, it turns back into a solid. When an ice cube tray full of water is put into a freezer, it soon begins to form a thin layer of ice on the top of the water. If you look closely, you can see that this thin layer is made up of small ice crystals. The same thing happens to molten or liquid metal when it begins to cool. The metal turns into small crystals beginning at the surface of the metal where it's the coolest. When cooled metal is hammered, or worked, the crystals in the metal are forced closer together, making the metal harder and more brittle (Figure 14).

Annealing and Pickling

Once a piece of metal has been hammered to make it hard, it can be made soft again by relieving the tight compression of the crystals. This process, called *annealing*, is the heating and cooling of metal to make it softer. When a piece of metal is annealed, it's heated just enough to turn it a dull red—not enough to turn it into its molten or liquid state. To anneal silver or gold, heat it to the point at which the metal is a dull red color. Don't apply too much heat, because a dull red can quickly become bright red and the metal soon begins to melt. Always keep the torch moving slowly back and forth across the metal. It's hard to see the metal temperature and color if you keep the flame in one direct line with the metal. After a little practice, you'll be able to control the amount of heat you're applying. When the gold or silver reaches a dull red, remove the source of heat and allow it to cool until it loses its color. Then quench it in water. This completes the annealing process. The annealed metal is softer because it's been relieved of its tension.

Once a piece of metal has been annealed, place it into a pickling solution to remove any fire-scale that has developed on the surface of the metal. *Fire-scale* results during annealing when oxygen combines with the outer layer of metal and burns or oxidizes it. The pickling solution is a dry, granular acid that's mixed with water and heated. It naturally eats off any fire-scale. Pickling solution is available from jewelry supply houses.

CAUTION

When repairing a piece of jewelry, be careful not to heat pin stems, clasps, and springs. These pieces have been hardened on purpose. If they absorb heat, they'll naturally be annealed and soften. Springs and clasps that are annealed lose their ability to spring back and must be replaced with new ones.

Gold, silver, and copper sheet and wire are available in different degrees of hardness: hard, soft, and dead soft. These varying degrees of hardness and softness are created in the refining and manufacturing process by the rate at which the metal is allowed to cool and by annealing the metal. Different applications of metalwork require different softnesses in metal.

For example, bezel wire and round wire are easier to work with when they're dead soft.

The Purpose of Finishing



FIGURE 15—Light is absorbed into irregular surfaces like the one on the left. A flat polished surface, like that on the right, reflects light and looks shiny.

A magnified view of an unfinished metal surface is illustrated at the left in Figure 15. When light strikes a rough surface, it's absorbed by the rough pattern and isn't reflected. A smooth polished surface, illustrated at the right, allows the light to be reflected. This principle of light reflection also applies to diamonds and colored stones, which are polished to a shiny surface to increase their ability to reflect light. This reflection, along with the color of the stone, is what defines much of a stone's beauty.

Metal finishing is nothing but a series of steps, or stages, in which metal is removed from a piece until it reaches a smooth, shiny appearance. Understanding metal removal is important to achieving a good final finish.

Many finishing steps and processes can be performed with mechanical equipment to save time. Some types of finishing require special equipment, but you should be aware of all finishing processes. To illustrate these processes, let's look at the steps used to finish a ring casting.



FIGURE 16—The jeweler is using compound cutting pliers to remove these castings from the sprue base. (Photo courtesy of William D. Reidsema)

When rings are cast, they're attached to a *sprue*, which is the way metal travels through the mold to form the ring. This sprue becomes part of the ring itself and must be removed (Figure 16). (Casting is covered in detail later in the program.)

Filing



FIGURE 17—A hand file can be used to remove the sprue stub from a ring. (Photo courtesy of William D. Reidsema)

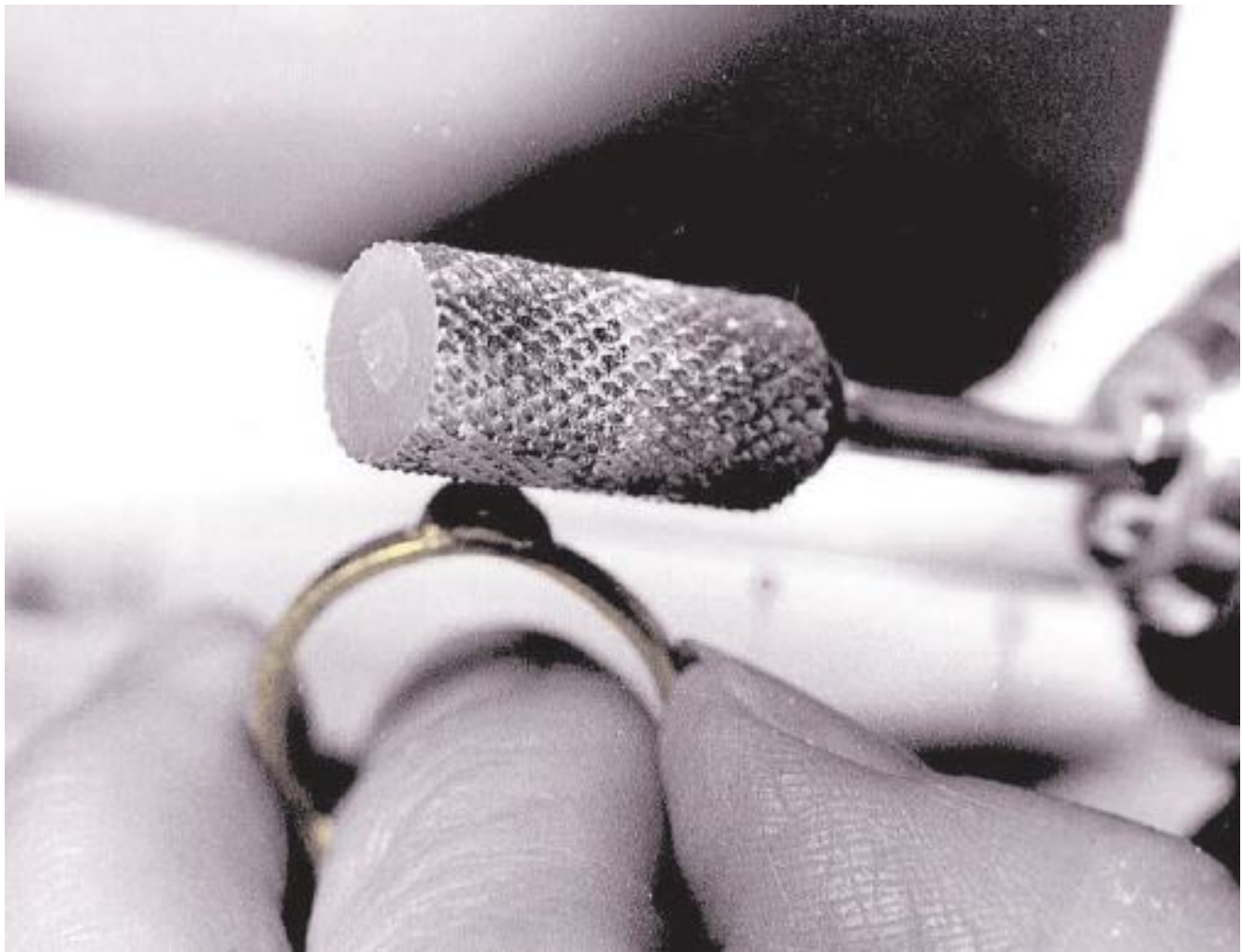


FIGURE 18—Here a rotary file in a flexshaft is being used to remove a sprue stub. (Photo courtesy of William D. Reidsema)

Filing is really the first stage in the finishing process. It removes large irregularities on the surface of the metal and begins the process of smoothing the metal. A hand file (Figure 17), rotary file (Figure 18), or grinding wheel can be used to grind the sprue stub to conform to the shank and to remove other irregularities. A rotary file can also be used to remove irregularities on the inside of a ring shank. Files are also used to blend, or smooth, one surface into another, to blend high and low areas into each other, and to create bold lines of definition.

Since most of the metal removal occurs during filing (and sanding—the next stage), you should have a collection system to trap and save the metal being removed. The lower tray

of the jeweler's bench traps most of the metal being filed or ground by hand methods. Save these filings so they can be reclaimed.

Stripping



FIGURE 19—The jeweler in this photo is using an electroplating machine to remove a small amount of metal and give the jewelry a bright appearance. (Photo courtesy of the P. H. Gesswein and Co., Inc.)

After sprue removal, jewelers and manufacturers have for many years used a process called *bombing*, or *stripping*. Stripping is the process of electrically removing a small outer layer of the ring material by reversing the polarity of a plating machine (Figure 19). A plating machine works on the same principle as a battery. Electric current flows in one direction or the other depending on polarity. A plating machine has a positive and a negative terminal to which articles of jewelry can be attached. If the jewelry is attached to the negative terminal and suspended in cyanide, a small amount of gold is electrically removed. (Electroplating and electrostripping are covered in more detail later in the course.) Electrically removing metal saves much finishing time because it can reach into and brighten deep areas that are hard to finish by hand.

CAUTION

Cyanide is a deadly substance. The fumes created by stripping metals consist of cyanide gas, the same basic gas used for executions in gas chambers. Cyanide is a carcinogen that can build up in your body. The information provided in this part of the course is to make you aware that many shops use cyanide-based strippers and plating solutions. Don't try to use cyanide solutions without proper equipment, and always follow the manufacturer's recommendations for its safe use.

Magnetic Finishing

Magnetic finishing is beginning to take the place of stripping. A magnetic finisher consists of a series of magnets of different polarities, spinning under a plastic bowl which holds the jewelry to be finished. Also in the bowl are small tapered pieces of steel shot and a soap-and-water mixture, which move in a spinning wave pattern as they react to the magnets underneath. This action causes the highly polished steel shot to rub against the articles of

jewelry. The shot is able to reach into small places that are hard to reach by hand. These machines have a gentle enough action that they don't harm prongs or fine detail. Magnetic finishing machines have been on the market for only a few years. They're very expensive—prices for small units begin around \$2,000.

Magnetic finishing and bombing don't remove large scratches. These procedures are used at this stage as a cleaning step. However, the magnetic finisher is also used as a last step to create a fine, high polish.

Sanding



FIGURE 20—Sanding drums like this one are used for sanding both the inside and outside of castings. (Photo courtesy of William D. Reidsema)

At this stage of the finishing process, the ring still has file marks that must be removed by sanding—the next step after filing. Sanding drums (Figure 20), which are used on a flexshaft, are available in five different grades of coarseness commonly called grits. The finest grit is a 320-grit sanding drum, which works well during this stage of finishing. Coarser grits remove more metal on very rough objects.

Sanding with a 320-grit sanding drum removes the large file marks, but leaves smaller sandpaper marks. These marks are removed by sanding with a fine grade of emery paper. Emery paper comes in sheets that must be cut into strips and wound onto a split mandrel for use in a flexshaft. A 600-grit emery paper removes sandpaper scratches and leaves a smooth finish.

Let's quickly review the first three steps of metal removal. First, remove a great deal of metal quickly with a file. Then remove less metal with a coarse sandpaper. Finally, remove even less metal and begin smoothing with a fine sandpaper. You can't achieve a good finish without all three steps. For example, if you try to start finishing with sandpaper instead of a file, the process takes much longer. Speed, as well as good results, is important in finishing.

Polishing

Once you've finished filing and sanding, you're ready to begin polishing. Polishing follows the same steps as filing and sanding. That is, you start with an aggressive, or coarse, polishing compound to remove a considerable amount of metal and proceed to a finer compound. You would think that by this time there would be no metal left! But less and less metal is removed in each step.

There are two basic steps in polishing: bobbing and applying rouge. *Bobbing* is the use of the coarsest polishing compound, commonly called Tripoli. The inside of a ring can be bobbed with a hard felt buff on the flexshaft or a tapered inside ring buff attached to a polishing machine. The outside of the ring can be polished on a muslin buff wheel and a polishing machine.

The polishing machine is equipped with a center motor that runs at a speed of 3450 rpm (revolutions per minute). The cabinet behind the motor has a fan that draws in the dust produced by the compound on the polishing wheel and the contact with the metal being polished. A filter traps this dust and returns clean air to the room. The speed at which the

motor spins is important. If the motor turns too slowly, it won't create enough "surface speed" at the point where the polishing wheel meets the object being polished.

Many beginning jewelers start by building their own polishing machine from an old electric motor. Since most electric motors run at only 1750 rpm, the surface speed is cut in half. The slower motors won't work quite as well as a 3450-rpm motor, but they'll get the job done. If you're starting out on a budget, like most beginners, consider making your own machine. The special tapered arbors that hold the polishing wheels on are available through most jewelry supply houses. When ordering the arbors, be sure you know the diameter of the shaft coming out of your motor. The main problem you'll have in building your own motor is providing a method of dust collection. If you can't build a dust collector, which most people can't do, be sure to use your homemade polisher outside or in a well-ventilated garage or basement. And don't forget to use a dust mask and eye goggles!

Commercial polishing machines have a shaft that extends from each side of the motor so the machines have both a left and right buffing wheel. The left buffing wheel is used for Tripoli, or bobbing compound, for the first rough polishing.

CAUTION

Because a polishing motor spins at a high rate of speed, it can grab and wrap things around it in the blink of an eye. Any loose clothing or jewelry you're wearing can be caught in an instant, pulling your hands and/or arms into the rotating machine. Remove all jewelry and avoid loose clothing. If you have long hair, tie it back before attempting to use any polishing machine. Ignoring any of these precautions may result in serious injury. Always pay close attention to the dangers of using a polishing machine.

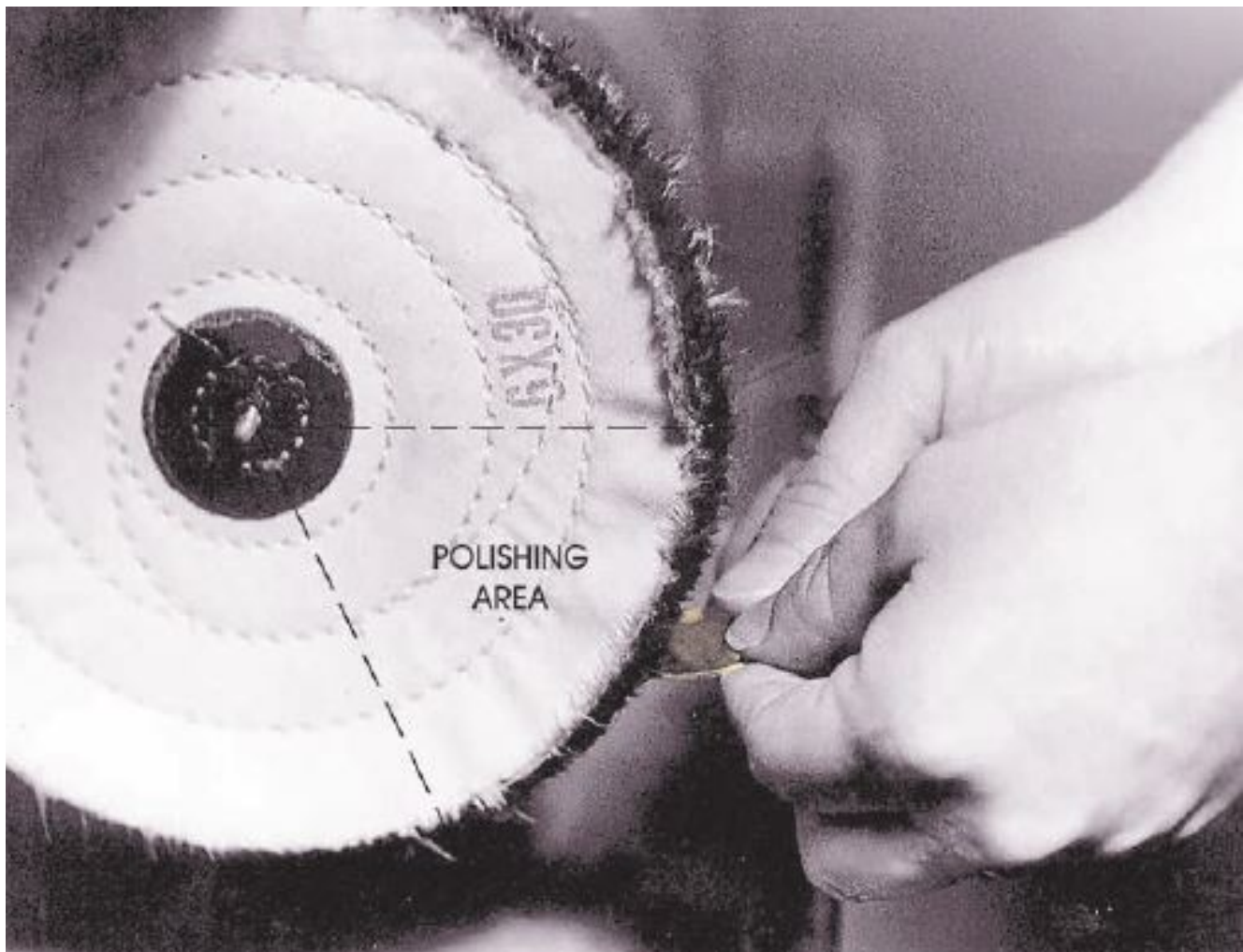


FIGURE 21—The first step in polishing is called bobbing. The jewelry being polished should be held in a breakaway grip as shown. (Photo courtesy of William D. Reidsema)

Firmly hold an object to be polished with your thumbs and forefingers (Figure 21). This is referred to as a **breakaway grip**. If the wheel grabs the object, it will pull it out of your fingers without pulling your hands into the machine.

Polish on only a small part of the rotating wheel. If you attempt to polish on areas outside the lines shown in Figure 21, the jewelry is more likely to be grabbed by the wheel and pulled from your hands. Move the piece you're polishing back and forth from side to side with a slight up-and-down motion. As you're moving the piece, turn it slowly so the surface of the object is polished evenly without removing too much metal from one area. Your goal in bobbing is to remove fine scratches and create a shine on the metal.

Inspect the piece often to make sure you're removing the scratches without polishing away more metal than you need to. Begin with light pressure and apply more pressure against the rotating wheel as you feel comfortable.

Soon, you'll get the feel of how much metal is being taken away. Be sure to keep the piece in continuous motion.

After you've removed all the scratches and have achieved a shine, move to the right wheel for the final polish. The right wheel, often called the *rouge wheel*, has a softer polishing wheel, often made of cotton or muslin. *Rouge* is a fine polishing compound used to create a bright final finish. Of the many types of final polishing compounds made, rouge has been the jewelers' standard for years.

To perform a final polish, apply rouge to the spinning buff wheel with a very light pressure against the wheel. Hold the piece in the breakaway position and press it very lightly against the wheel. To achieve good results, keep the piece in constant motion as you did in bobbing.

Learning to polish properly takes practice. In the beginning, expect to have the pieces you're polishing pulled from your hands. This may startle you the first few times because the jewelry bangs off the back of the machine. Practice on inexpensive items without stones, since the jewelry may be damaged when it hits the back of the polisher. After a few hours of practice, you should be able to hold objects so they won't be pulled away by the wheel.

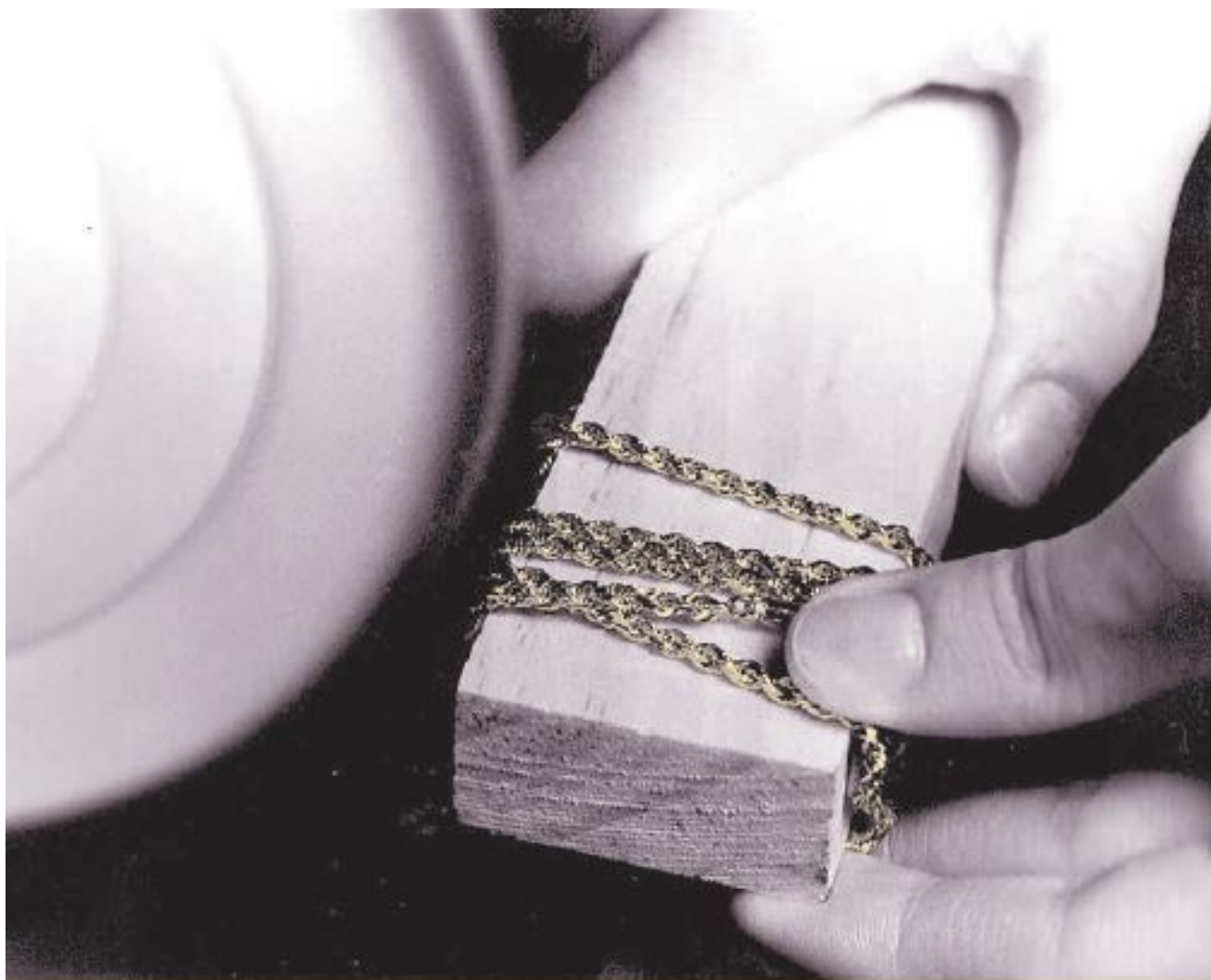


FIGURE 22—When polishing a chain, wrap it around a piece of wood to prevent it from being grabbed by the polishing wheel. (Photo courtesy of William D. Reidsema)

When polishing chains or bracelets, wrap them around a piece of wood so they aren't loose and dangling (Figure 22). The turning wheel can quickly grab a loose chain and cut your hand as it's pulled away. You can reduce the chance of this happening by wrapping the chain around something that gives you better control.



FIGURE 23—A split lap machine is used for polishing flat surfaces. (Photo courtesy of P. H. Gesswein and Co., Inc.)

A split lap machine (Figure 23) is for polishing flat surfaces. Because its hard, flat wheel has no “give” to it like a polishing wheel, it produces a perfectly flat polished surface. The underside of the wheel is used as the polishing surface, and the splits in the wheel allow you to see the object from the top as the wheel is rotating. Split laps are used for making the sides of ring shanks flat and true after they’ve been sized and for polishing other flat surfaces that would be distorted by a standard polishing wheel. Split laps can be used in the bobbing stage with coarse compound to remove a great deal of metal quickly. They cut so much metal that often the sanding stages can be eliminated.

Polishing wheels and split lap machines cut away metal by friction, which produces heat. This heat is quickly conducted to your fingers through the metal. Harder metals, such as silver and copper, require more friction to polish and therefore produce much more heat than gold objects. Small leather devices, called finger protectors, can be worn on the tips of the fingers to protect them from this heat. Unfortunately, they don’t allow you to “feel” what’s happening to the metal you’re polishing. However, if you plan to polish for an extended period of time, they do provide good protection from heat and from the buildup of polishing compound on your fingertips, which is very difficult to remove.

Practice: Metal Finishing

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Final Touches

Metal Cleaning

After any piece of jewelry has been polished, traces of compound will remain on both the surface of the object and in recessed areas. Therefore, the last stage of finishing is to remove this residual compound. A mixture of ammonia and a few drops of hand dishwashing liquid can be applied with a soft toothbrush to remove much of this unwanted material. This procedure is fine for cleaning a few pieces and does a nominal job. Production work, however, requires an ultrasonic cleaning machine or a steam cleaning machine.

Ultrasonic Cleaning

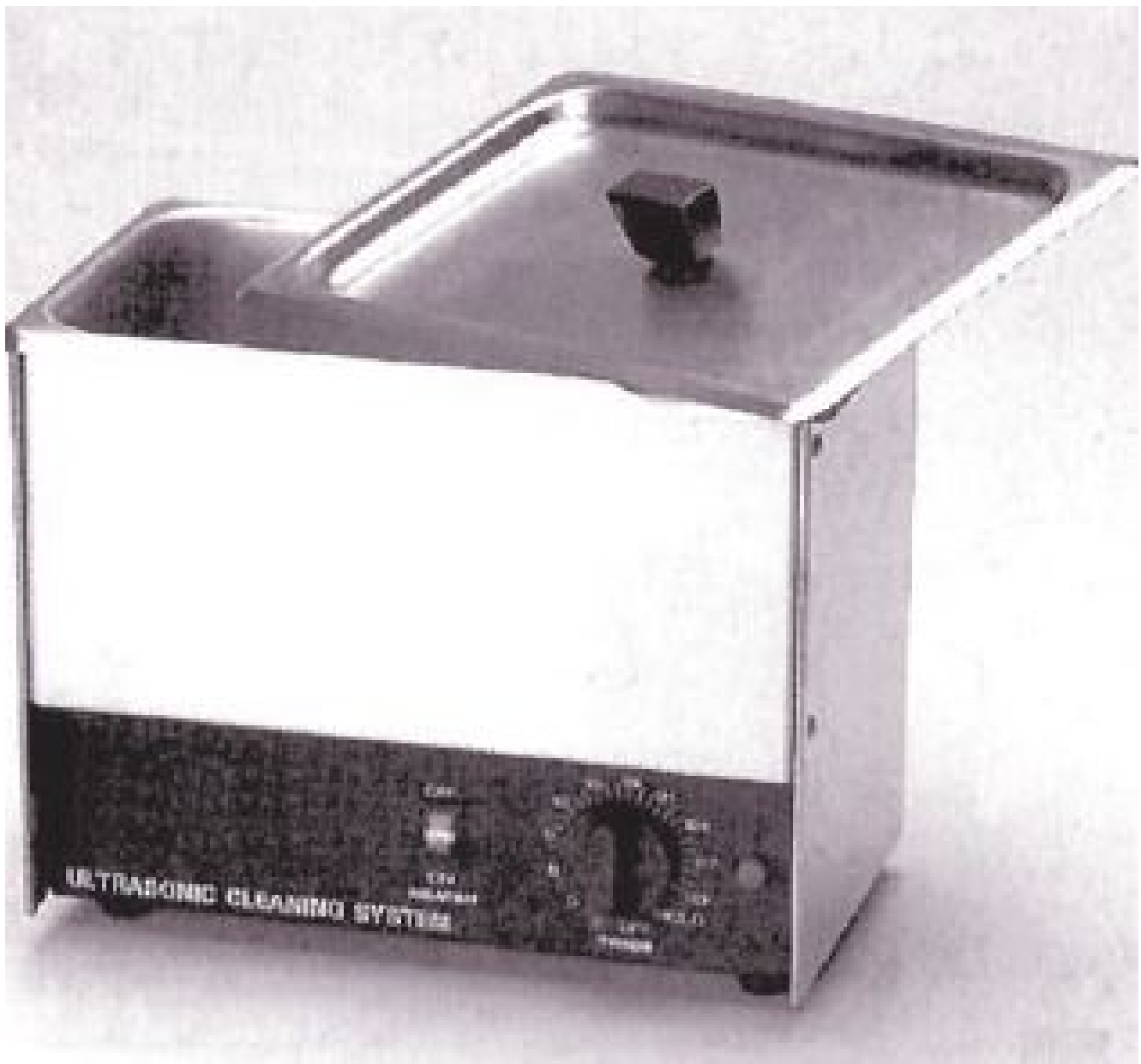


FIGURE 24—An ultrasonic cleaner uses transducers to create microscopic bubbles that clean the jewelry. (Photo courtesy of P. H. Gesswein and Co., Inc.)

An *ultrasonic cleaning machine* (Figure 24) consists of a stainless steel chamber to which cleaning solutions are added. Attached beneath the chamber are small transducers, which vibrate so quickly they produce ultrasonic waves that move through the solution. As these waves travel through the water-based solution, they push microscopic air bubbles into the

objects being cleaned. This bombardment of microscopic bubbles creates an agitation that dissolves and removes the polishing compound from the jewelry. Ultrasonic machines are expensive cleaning devices that are priced according to the wattage they put out. The higher the wattage, the more cleaning action the machine has and the more expensive it is.

Using an ultrasonic machine to clean jewelry set with certain gem-stones can ruin the stones. You'll study more about this in the study unit on gemstones. For now, just remember that emeralds, opals, and pearls shouldn't be cleaned in an ultrasonic cleaning machine.

Once an article is removed from the ultrasonic machine, it's washed in warm water to remove the cleaning solvents and then wiped with a soft cloth. The jewelry is now ready to go to either the customer or the showcase. If the ultrasonic machine doesn't remove all the foreign matter than can be left on a ring or other item of jewelry, a steam cleaner is often used.

Steam Cleaning





FIGURE 25—Steam cleaners use a blast of high-pressure steam to remove dirt from jewelry. (Photo courtesy of P.H. Gesswein and Co., Inc.)

A *steam cleaner* (Figure 25) is a water-filled device that produces high-pressure steam. The operator releases the steam in powerful spurts and directs it to the parts that need to be cleaned. A steam cleaner has the same effect as a high-pressure hose at a car wash. The blast of steam and water forces foreign debris from the jewelry.

Steam cleaners are used for giving a super cleaning in a few short seconds to diamonds and other stones that can stand the heat produced by the machine. The steam cleaner can damage certain stones, just as the ultrasonic cleaner does. The same three stones—emeralds, opals, and pearls—should never be cleaned with a steam cleaner. Other sensitive stones will be covered in a later study unit.

Special Finishes

Rings, pendants, bracelets, and other jewelry are usually finished with highly polished surfaces. The attractiveness of many pieces comes from simple design elements such as balance, form, and texture. The element of texture is the focus of this section.

Texture gives a piece of metal a distinguished look, because a textured surface no longer reflects light in the same manner as a highly polished surface. Generally, texturing is done on a specific area next to a highly polished area, which then makes the highly polished part stand out. This variety in texture is called *contrast*. The remainder of this unit covers basic texturing finishes that are usually done as the last step in finishing to create special effects. These finishes are Florentine, matte, and oxidizing.

Florentine

Florentine is a fancy French word for “scratched finish.” It sounds much more professional than “rubbed with sandpaper” or “ground with a rough wheel,” but this is how the finish is achieved. Florentine finishes are used mostly on higher raised parts of jewelry, while the lower surfaces are left with a high polish. This technique creates an interesting, contrasting finish, which gives many pieces a totally different look. Just a small amount of Florentine in the right areas can make a plain design look more stylish and appealing.

Florentine finishes can be applied by hand or with a rotary handpiece. When doing Florentine by hand, you'll generally use sandpaper to create the finish. A rough 80-grit sandpaper is used to make a deeply scratched look. Start with a piece of jewelry that has already been thoroughly polished and cleaned. It's very difficult to polish recessed areas on a piece that's been Florentined. Usually some of the scratched Florentine finish is worn away and dulled by the polishing.

To create a Florentine finish, hold the piece of jewelry against the benchpin and steady it in one hand. With the other hand, quickly whisk a small piece of folded sandpaper across the desired area. Be sure to do this quickly and rigidly to maintain better control of the sandpaper. If you use a loose grip and move slowly, the paper will bend and drag into the more shallow area of the ring. Try different grades of sandpaper to create different Florentine looks.

A Florentine finish can also be applied with a multi-line flat graver tool. The jeweler uses this tool to scratch parallel lines in two different directions.

When you use a fine grade of paper, around 220 grit, the finish created is referred to as *satin*. Very fine satin finishes can be created with special fiberglass brushes made for jewelers. When using these brushes, be sure to wear a mask and eye protection. The bristles, which are made of fine glass particles, flake off during use and can cause irritation if they're inhaled or come in contact with the eyes.



FIGURE 26—A rough wheel is being used to create a Florentine finish on a wedding band. (Photo courtesy of William D. Reidsema)

Any type of abrasive rotary tool can be used to create Florentine finishes (Figure 26). The small grinding wheel is a particular favorite because of its rough surface. When using a rotary tool, hold the object in one hand and loosely hold the handpiece in the other. To create a good Florentine finish, allow the wheel to lightly touch the surface of the item. Run the rotary handpiece at the slowest speed possible. Then lightly touch the piece and back away, touch it and back away, while moving to the different areas to be highlighted. Try different grinding wheels, burs, and grades of sandpaper to become familiar with the multitude of different finishes you can create. Experimenting in this way will help you become familiar with which tool to use to match different finishes that you encounter.

Matte



FIGURE 27—A small, handheld sandblaster is used for cleaning and making matte finishes. (Photo courtesy of William D. Reidsema)

Matte finishes are made with a miniature sandblaster (Figure 27). Very small sand-type particles made of either glass, crushed synthetic ruby, aluminum oxide, or quartz are forced by high-pressure air against the metal to create different surface textures. Matte finish is used mostly on lower surfaces of jewelry; the higher surfaces are then buffed to a high luster. Sand blasting, or bead blasting, as it's sometimes called, can cut down on the finishing time of recessed areas, because these areas don't have to be prep polished before blasting.

An air compressor is needed to provide a volume of high-pressure air at about 100 psi (pounds per square inch). When this air is forced through the small handheld blaster, it picks up the minute particles from a small bottle at the base of the gun. Notice this bottle in Figure 27. The extreme velocity at which the particles hit the metal provides abrasive action.

Sandblasting is best done in a cabinet that recycles the abrasive medium being used. Abrasives are so fine that they float in the air freely and can cause damage to the lungs if inhaled. If you don't have a cabinet to use when blasting, cover the work with a cardboard box with holes cut in it for your hands. Cut another hole in the top of the box and lay a piece of glass over it, so you'll be able to view your work. Make sure to wear a rated respiratory mask; paper masks don't offer enough protection from dust this fine.

Oxidizing

Another finishing process, called *oxidizing*, colors or darkens areas of a piece of jewelry. As you've already learned, oxidation is the reaction to and absorption of oxygen by a metal. As a finishing procedure, oxidizing is the application of certain chemicals to darken or change the color of metals by a chemical reaction. Complete books are devoted to "recipes" for changing the colors of a variety of metals.

Most jewelry houses sell darkening and coloring agents. Since many of these products contain acids and irritants, make sure to follow the manufacturer's instructions for using them. *Note:* The oxidizing process occurs much faster when the item to be oxidized is heated.

Experimenting in the area of coloring metals is the only way to achieve the colors you desire. As a bench jeweler, you'll rarely have to match any color of oxidation other than black in an occasional class ring you've sized. For such cases, you can paint on a special background solution. Since these solutions contain no acids, they cause no reaction to the surface of the metal and are therefore safer to use.

As you've just seen, many different steps and techniques can be used to polish and finish jewelry items. As you experiment and practice, you'll probably come up with some of your own techniques to save time and produce different textures and finishes. In the units on soldering and ring sizing, you'll learn some special timesaving tips that apply to different types of repairs you'll perform as a bench jeweler technician. These tips and techniques can save you time and make money for you as they help you become skilled in a financially rewarding career.

Practice: Final Touches

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Project 1: Creating a Monogram Pendant



Lesson 2 Overview

In this project, you'll take some of the basic knowledge you now have about tools and metals and combine that knowledge with experience as you create your first piece of jewelry. These hands-on projects will help you begin to gain the practical experience needed to become a jewelry repair technician. You'll need a lot of practice, though, to train your mind and hands to work together for the basic operations of sawing, filing, drilling, and finishing. The time you spend practicing directly affects how well you do in the real work environment.

Before We Begin

Anything that requires a great degree of hand-eye coordination should be practiced. Working with jewelry is no exception. Have you ever stepped up to the controls of a video game and gotten the lowest score in history right after watching a young child do extremely well at the same game? Your hand-eye coordination in relation to the game isn't as developed as the child who has spent hours at the controls. Similarly, when you first pick up a jeweler's saw or file, the tool will feel foreign and difficult to use because you haven't worked with it on a daily basis. Just remember that this awkwardness will pass. You shouldn't feel discouraged if you're fumbling through a project or getting poor results. Keep practicing on a regular basis to build up your confidence and ability.

The great part about practicing jewelry repair is that it's enjoyable. In addition, the materials are easy to obtain: brass is inexpensive to use as a practice metal, and sterling silver is relatively low in cost. If you've got a penny, you can use it to practice drilling, sawing, and filing! We're about to move on to the project and develop some hands-on techniques that you can practice regularly.

Learning through Imitation

When we approach any piece of jewelry, whether it's something we're making or repairing, we must take time to think about how we want the final product to look. If we were mixing the batter for a chocolate cake, it would be very easy to picture the finished cake. However, for most of us, the art of jewelry repair is a much more difficult thing to picture. To become someone who fashions and fixes jewelry, you must know what the final product will look like before you start.

When we were children, we learned how to do things by watching other people do them and then doing them ourselves. Learning to speak, for instance, is done by imitation, and it's not until we've imitated other people many times before we learn how to pronounce a new word. Artists learn how to paint by copying the works of master painters. Try doing the same thing as you begin jewelry repair and jewelry making. Copying someone else's design in order to learn is an acceptable practice. It's very common for someone to admire a particular style or period of design and fashion his or her work after it. This is something you're expected to do as a beginner, as it helps you to learn. Copying someone else's design and calling it your own, of course, is not acceptable.

A lot of bench jewelers have artistic talent when it comes to the area of design. Many more aren't naturally artistic, but still produce quality work. A bench jeweler isn't usually hired to do design work, but to construct the designs that other artists have created.

Understanding Balance

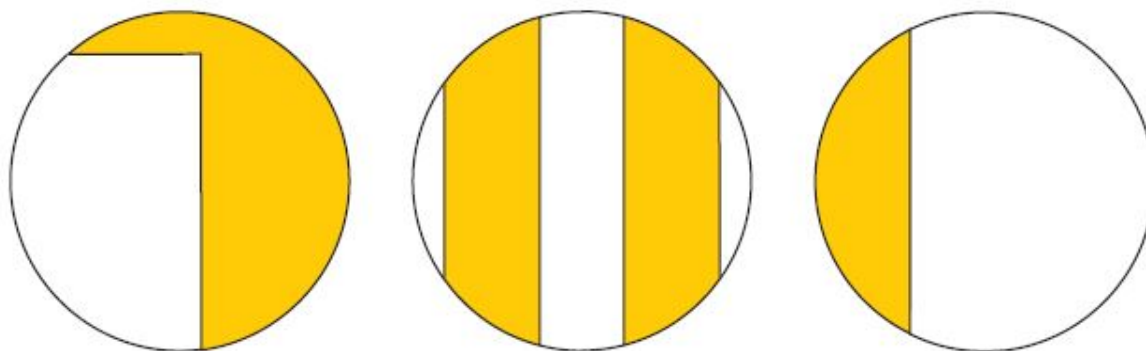


FIGURE 1—The center design has a more balanced visual weight.

A balanced design is one with parts of equal visual weight when we cut it in half. Visual weight is how light and dark or thick and thin each area of the total piece is. Figure 1 shows three circles. Each of them has visual weight. The center circle is more balanced and thus, more visually appealing because the weight of light and dark is distributed equally.

You'll be making a pendant with letters in the design. These letters must be uniform and equally spaced in order to be visually appealing. The letters in the pendant will be the first, last, and middle initials of a person's name. This is referred to as a monogram style. In monogram styles, the last letter of the person's name is usually, but not necessarily, larger and placed in the center of the design. The first and middle initials of the person's name are generally smaller and placed to each side of the larger letter. The larger middle letter of the monogram style works well within the circular pattern you'll be using.

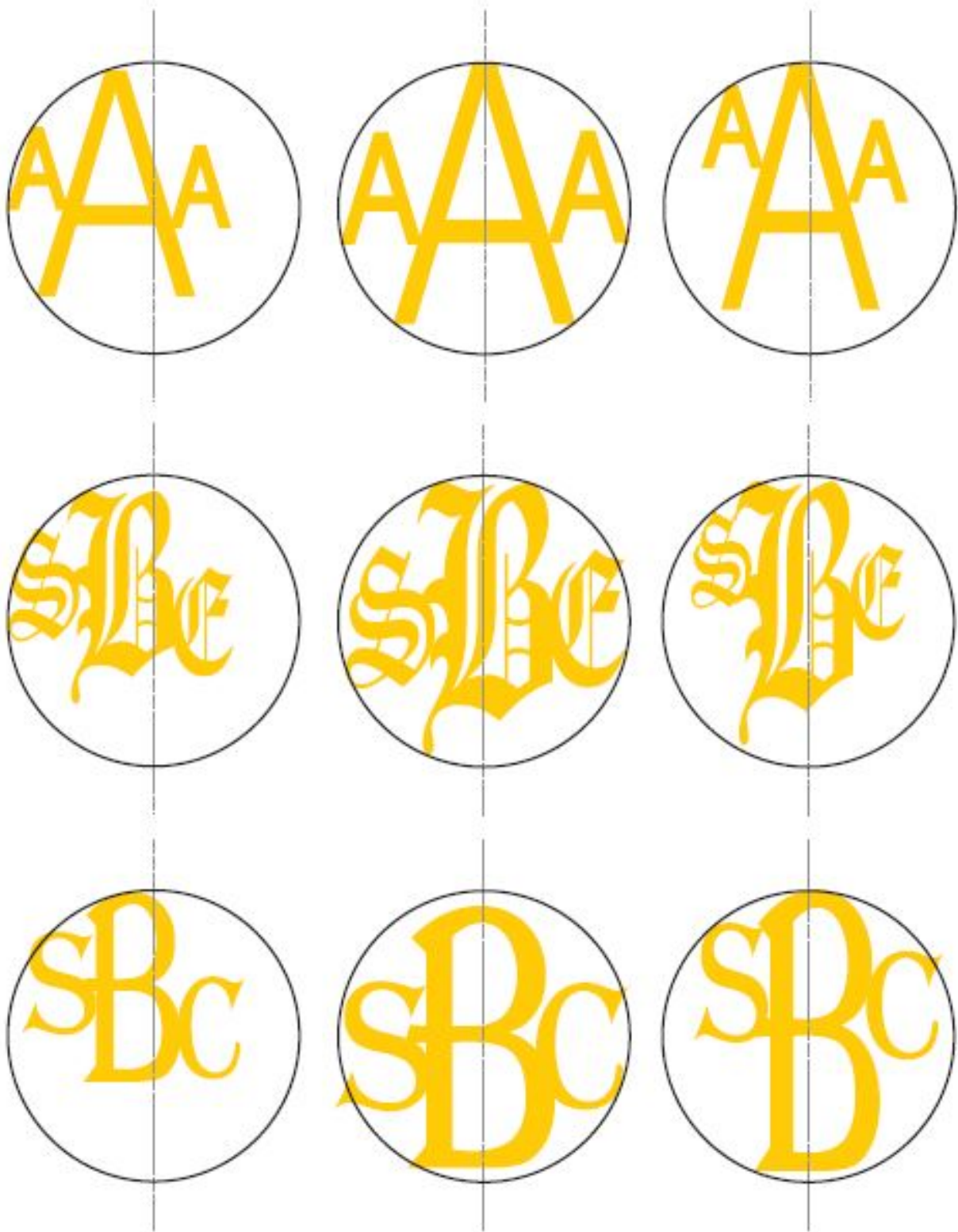


FIGURE 2—The center design is symmetrical and thus, more visually appealing. You can see that we've applied symmetry to our pendant design and to other designs as well.

Figure 2 shows three different lettering layouts. As you can see, the layout that looks best is the one with equal parts when we cut it in half. This is the best way to arrange our letters. Did you notice how your eye is naturally attracted to the balanced design? The design is symmetrical and easier to look at. Designs that are symmetrical contain equal, repeating patterns. The other two layouts appear uneven by comparison.

Practice: Before We Begin

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Making the Pendant

Creating Points of Reference



FIGURE 3—Tracing a Template

Begin by drawing on paper what you want your pendant to look like. When drawing round shapes, it's easiest to use a template. A template is something that's already the exact shape and size we want to create. When you trace this object, it's considered a template. Pennies, nickels, dimes, and quarters are all different-sized templates. Use a quarter as a

template for your pendant, as it's the size you want for this project. Trace a quarter onto a blank piece of paper as illustrated in Figure 3.

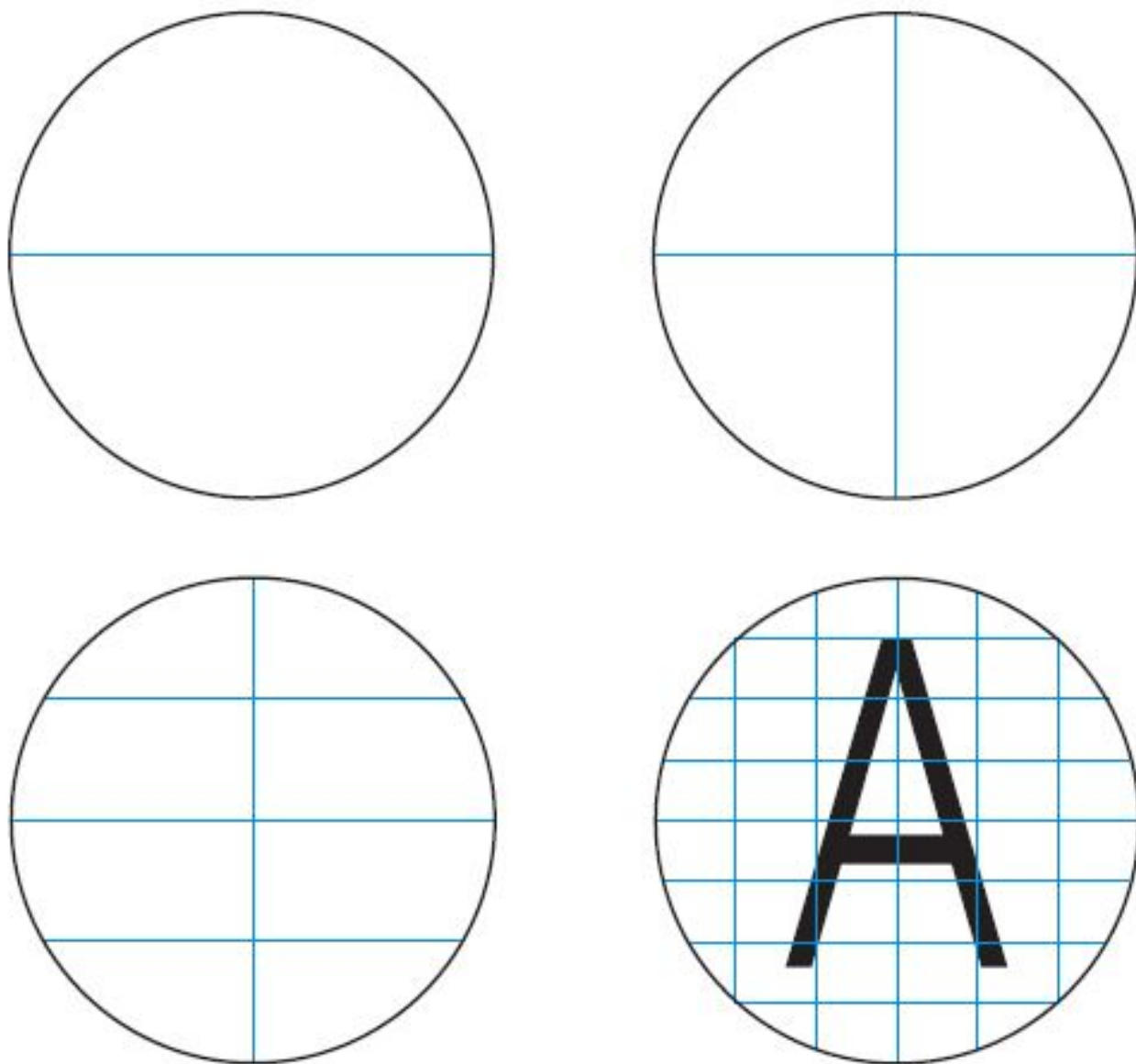


FIGURE 4—Creating Points of Reference

If you draw your letters in the center of the circle, it's hard to space them evenly. You have no point of reference to help you begin your design. Make your first point of reference by

dividing the circle in half and then in half again, as in the top two illustrations of Figure 4.

You're taking the large area of the circle and breaking it down into more manageable parts. If you were working with another shape, such as a square or triangle, you would also divide it into this gridwork pattern. By making an even gridwork of lines for reference, we can keep our design evenly spaced; breaking down the main shape into tiny segments is the secret to proper layout. This system will be used whenever you're laying out jewelry patterns that might require evenly spaced stones or equally distanced drilling. It removes guess-work and provides a way to make the work manageable. As you continue dividing each line in half as in the last two illustrations of Figure 4, the design is broken down into smaller and smaller segments. The smaller each segment is, the more accurate our symmetrical design will be.

It will most likely take a number of drawings before you arrive at one that's the exact style you want. Don't feel limited to just lettering. Make a second pendant using your own design, if you wish. There's enough metal in the first instruction pack for this.

Preparing the Metal

Now that you have a design, you need to prepare your metal. A piece of 20-gauge brass sheet is included in the first instruction pack. You should inspect the metal for any scratches caused by normal handling and prepolish the metal before you begin. Prepolishing means lightly polishing the metal to remove any surface oxidation and distracting blemishes. It gives you a bright, clean surface to work with.

When choosing metals with which to make a piece of jewelry in the future, you should consider these questions:

- Is the metal thick enough to hold up under everyday use, but not so thick as to make an uncomfortable piece of jewelry?
- What is the cost of the metal in relation to what a customer expects to pay for the finished piece?

We'll discuss these questions in more detail later in the course, but you should keep them in mind as you get the feel of actually working with metal.

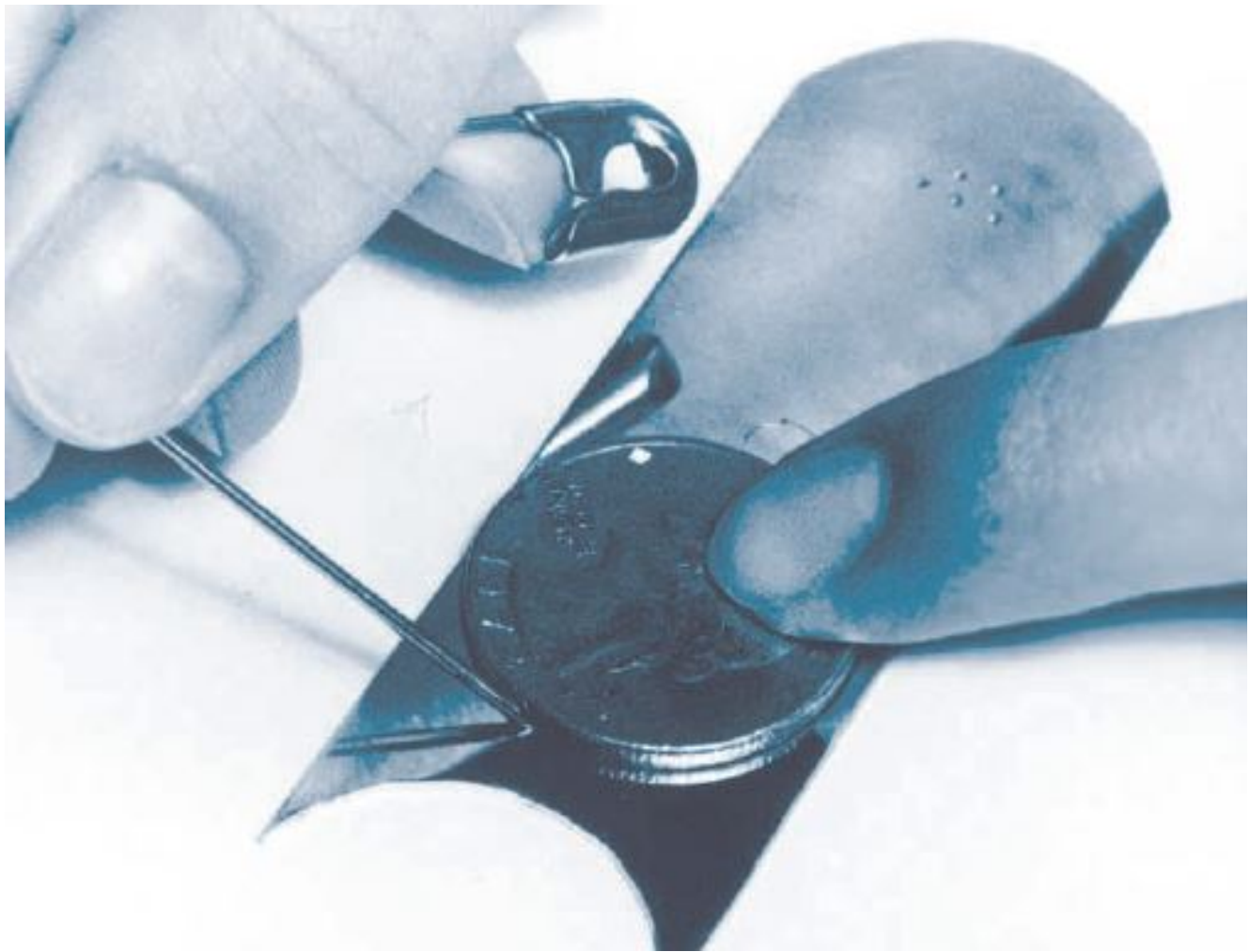


FIGURE 5—Tracing on Metal

After choosing, examining, and prepolishing the metal, you'll scribe the shape you want onto the metal. Taking the quarter again, scribe its outside diameter onto the metal surface. In Figure 5, we're using a safety pin as a scribe.

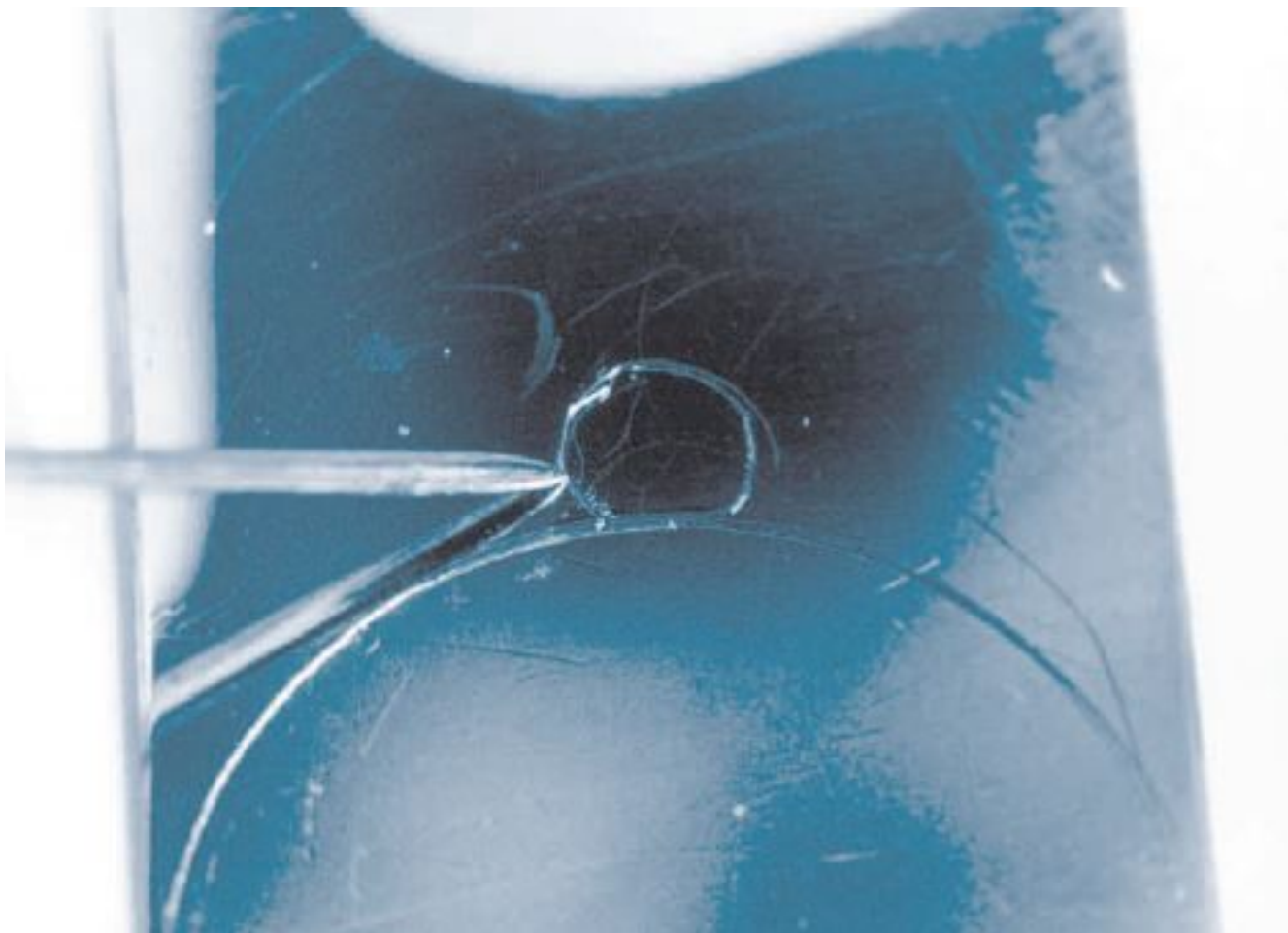


FIGURE 6—Creating a Bail

Before you start to cut, the pendant must have a small hole at the top to which a bail will be attached. A bail is a loop which suspends the pendant from the chain. A small loop that's a separate part of the pendant looks much better than a hole drilled through the pendant itself. Make this loop by scribing another small circle on the very top edge of the pendant. This can be done by hand as in Figure 6. Mark it well so it can be seen while sawing and isn't accidentally cut off.



FIGURE 7—Drilling the Hole

Now you should drill a hole in the center of this loop as in Figure 7. You can use the drill to compensate for a hole that's not perfectly centered. We should note now that the order of steps you take in making a piece of jewelry is important. If you had cut the loop first and been slightly off in your drilling, you might have had to start over. Always look ahead a few steps and determine the easiest and most efficient way to prevent any possible errors.

Cutting the Metal



FIGURE 8—Cutting the Metal

As you support the metal firmly on the bench pin, allow one edge of the metal to hang slightly over the pin and begin sawing. (Before attempting this step, you may wish to review the information in Unit 1 on how to install the blade in the saw frame.) Make sure the saw blade is at a 90° (degree) angle to the workpiece, and cut on the downward stroke as in Figure 8. Slight pressure is all that's needed.

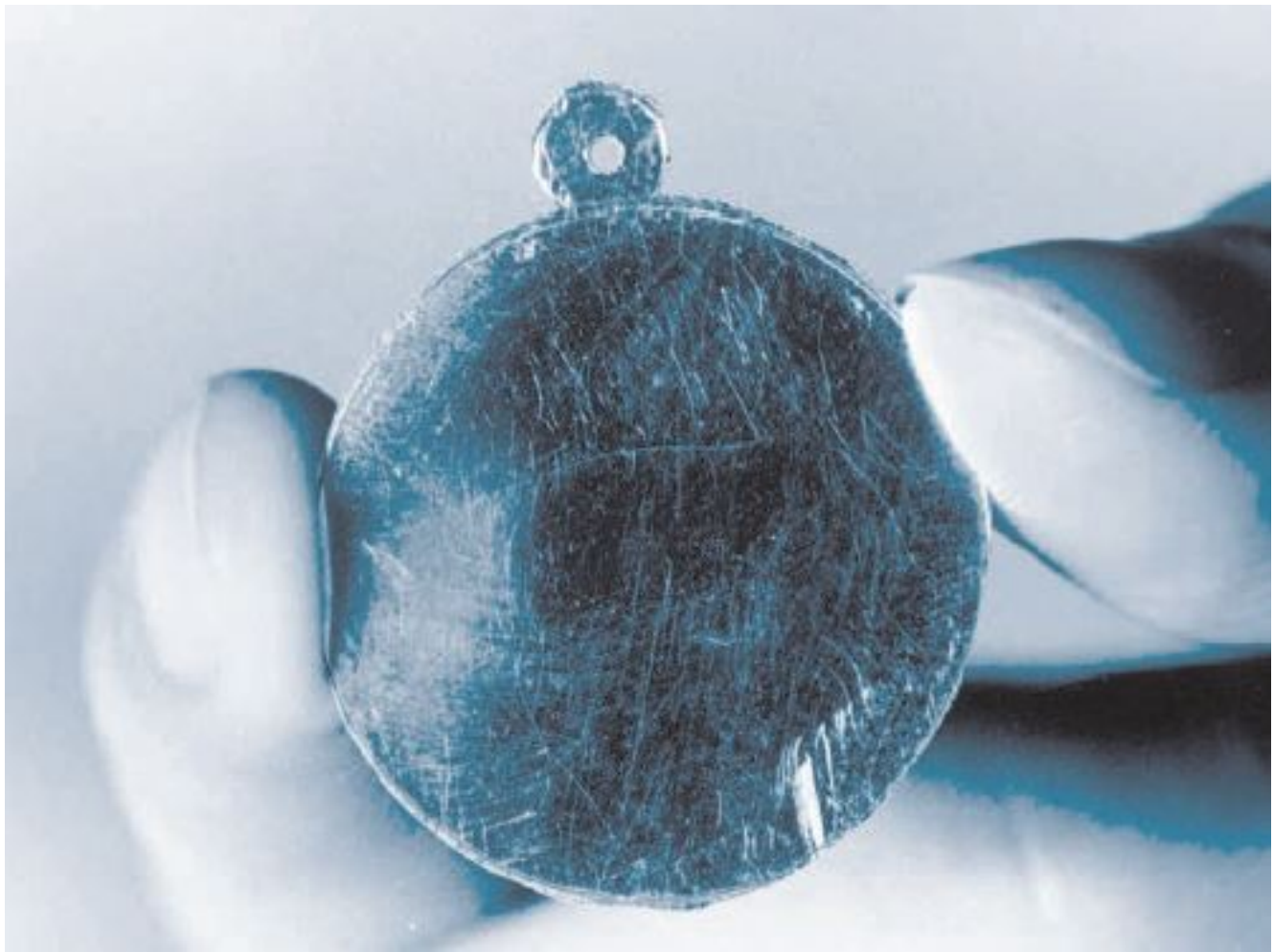


FIGURE 9—The Completed Disc

Make sure to saw along the outside of the scribed lines. If you try to saw exactly on the scribed line, you may cut into the body of the pendant farther than you intended. Your completed disc with a loop should look like Figure 9.

After cutting along the outside, file and sand away the excess. Files and sandpaper allow for finer control over the final design. Sandpaper is sold in single-sheet or multiple-sheet packages through local hardware stores. The sheets are graded by a numbering system as to their roughness or fineness. The smaller the number, the rougher the surface. Emery cloth is a sandpaper that has a cloth backing so that it may be used with water. (Water is used to prevent heat buildup and for washing away the sanded particles, although it's seldom used in jewelry work unless you're sanding enameling work or gemstones.) Emery cloth typically lasts a little longer than standard sandpaper, especially in the finer grades. A

good selection of sandpaper or emery cloth for use in jewelry repair includes an 80 grit for making scratched finishes, a 120 grit for heavy metal removal, a 320 grit for medium metal removal, and a few pieces of fine emery cloth in the 800-grit to 1200-grit range for fine finishing.

File the excess metal right down to the edge of the line. Then use a piece of 220-grit sandpaper wrapped around a block of wood to smooth the edge further. Finally, rub the disc with fine emery cloth to produce a bright finish.

Transferring the Pattern



FIGURE 10—Gluing the Design to the Disc

The cut and prepared metal now has the disc shape of a pendant. You're ready to transfer the paper pattern to the metal. We offer two ways to do this. The method pictured involves gluing the template to the metal. Cut out the paper template pattern of your design and apply a light coat of glue to the disc. Any type of white all-purpose glue will work. However, some technicians find that rubber cement works more satisfactorily. Apply the paper pattern to the disc as in Figure 10 and allow it to dry for at least one hour. Set some books on top of the pendant while the glue is drying to assure a smoothly bonded surface.

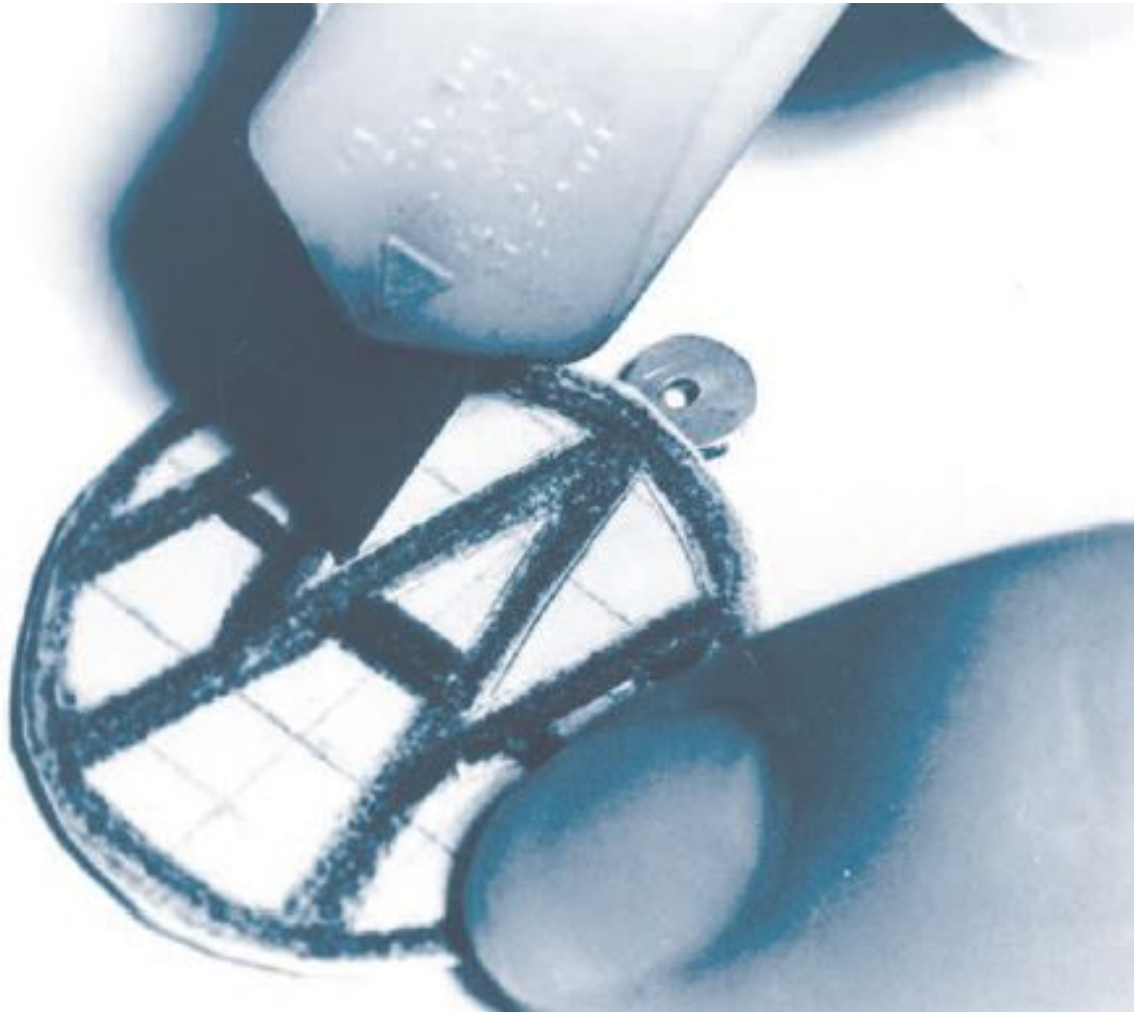


FIGURE 11—Cutting Design Lines into the Metal



FIGURE 12—The Finished Design

After you glue the design to the metal, you're ready to transfer the pattern. Begin by using a sharp razor to cut through the paper into the metal. Cut all of the straight lines first, as they're easier than circular lines. Keep your fingers above the blade at all times so you're not cutting towards them. A sharp blade will require only slight pressure to cut all the way through the paper and leave a good scribed line on the metal surface (Figure 11). After cutting all of the lines, moisten the paper slightly. It will come off by scraping it with your fingernail. The traced lines should look like Figure 12.

At this point, you may notice some parts of the pattern aren't centered. You have the option of compensating by eye as you recut the pattern, or turning the disc over and

drawing another pattern. Compensation is necessary in many jobs and another skill you'll learn through practice.

Another method involves the use of carbon paper. Place a piece of carbon paper between the final draft of your design pattern and the metal. Feel the edges of the metal with your finger to correctly position the design. Then trace the design pattern with a pen. The carbon tracing lines should become visible on the metal.

Painting the metal with typing correction fluid or artist's Chinese white paint will add greater definition to the carbon-copied lines. After the tracing is complete, you can scribe the design on the metal with a sharpened nail. Once this is done, the carbon and paint may be cleaned from the metal.

Cutting the Pattern

You have two options at this point. One is to cut away all of the metal that surrounds the design; this produces a positive image. The second option is cutting out the shape of the letters in the design; this will give us a negative image. The positive image is generally regarded as more attractive in this style of work, so for this project you'll cut away the metal that surrounds the letters. Remember: a positive image always leaves the design area and a negative image always takes it away. You can experiment with both positive and negative cutouts to see the different effects they give to designs.

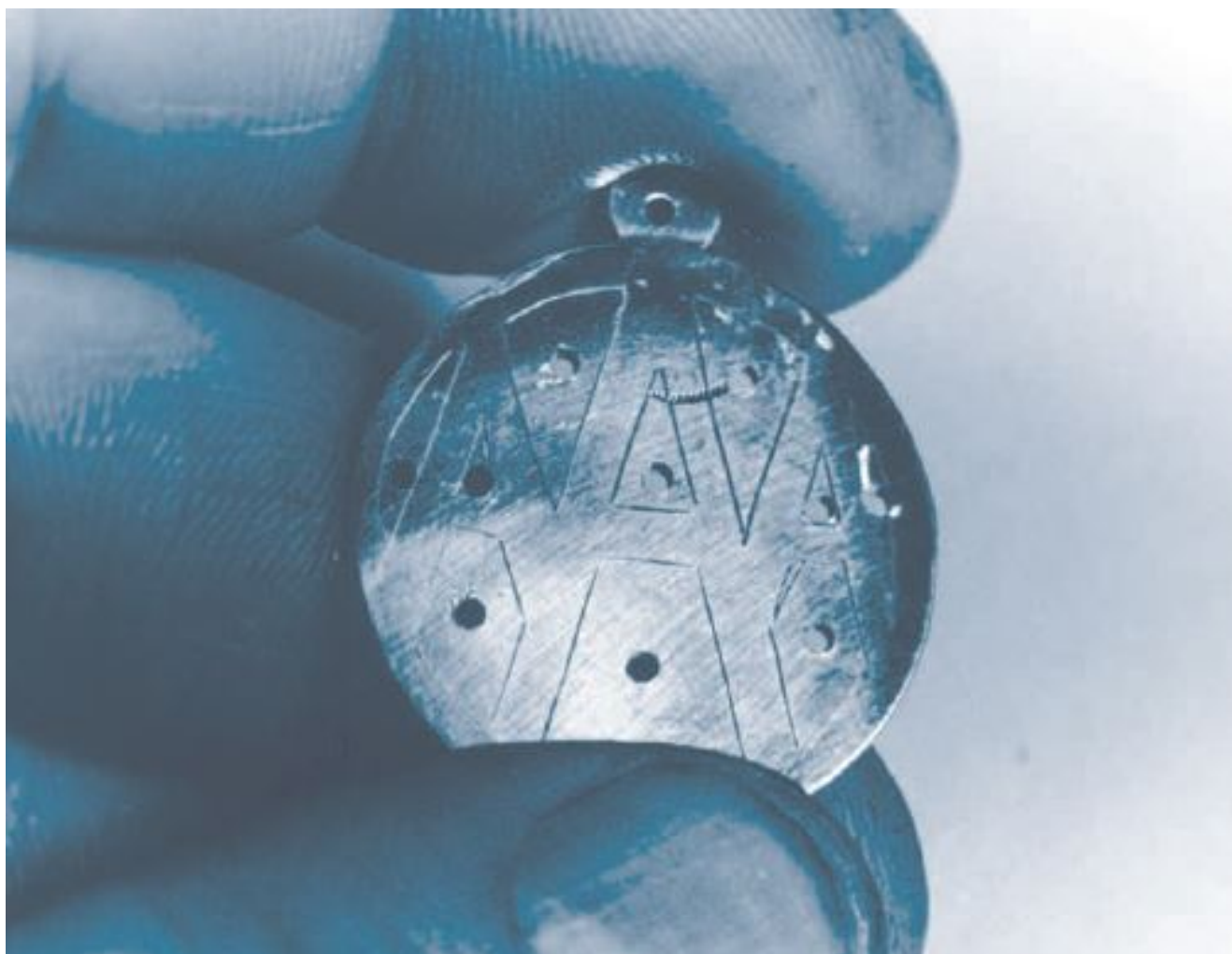


FIGURE 13—Piercing Work

In order to saw away sections of metal without cutting through the edge of the pendant, you must drill a series of holes in every section that's to be removed. This is known as piercing work, in which you remove small amounts of metal by internal cutting. Using a center punch or any sharp solid object such as a small, used drill bit, make a small dent in each section to be drilled. The dents will act as guides for the drill. Drill small holes with the 52 drill bit that's supplied through each of the sections (Figure 13).



FIGURE 14—Sawing a Positive Design

Open one end of the saw frame and guide the blade through the first hole. It's very important that you lay the disc flat on the bench pin and hold it firmly in place while sawing in order to achieve a precise cut (Figure 14). If the metal isn't held firmly, it will bounce around and break the saw blade.



FIGURE 15—Truing the Edges

When you come to the end of each cut and need to change direction, keep the saw moving up and down with no forward pressure. Turn the workpiece very slowly while maintaining the up-and-down motion of the saw. After you've made the turn to a new direction, you can proceed with a light forward pressure. The saw should almost "feed" itself, as so little pressure is required. In this project, be especially careful not to cut beyond the scribed lines of each letter "A". After cutting out the completed pattern, the straight edges can be trued by filing them with a nail file or small jeweler's file as in Figure 15.

Final Finishing and Attachment

Now you're ready for the final finishing steps. There were undoubtedly numerous scratches created while you worked with the metal, so you'll want to sand the surface of the pendant to give it a smoother appearance. When sanding flat areas, it's often a good idea to lay your sandpaper or emery cloth on a hard, flat surface, such as a piece of glass. This will allow you an even finish as you slide the workpiece back and forth. Rotate the piece you're sanding frequently to prevent uneven results. As you use finer sandpaper, a 1200-grit fineness, for instance, the surface of the metal will begin to shine.

At this point, some jewelers will use a polishing wheel. This is a tool that carries polishing compound to the jewelry. By rubbing vigorously with the polishing cloth provided, though, you can remove very fine scratches and create a bright final finish.



FIGURE 16—The Finished Pendant

A solution of one cup of hot water, one-half teaspoon of dishwashing liquid, and one-eighth cup of ammonia makes a good cleaning mixture for removing any compounds and dirt left behind after polishing. Scrub the pendant lightly with a soft toothbrush, making sure to reach all the recesses where compounds accumulate. Figure 16 shows what a finished pendant looks like.



FIGURE 17—Bending an O-ring

In order to attach the pendant to a chain, a connecting O-ring must be used. The O-ring is a circular ring made of wire stock that will suspend the pendant from the chain and also allow it to swivel. Take one of the supplied O-rings and bend it sideways as in Figure 17. Never spread an O-ring apart to make its circumference larger—always bend it from side to side. If a ring is spread apart, it's very difficult to bend it back into shape. If it's bent from side to side, though, the edges “mate” more easily as they're twisted closed.

You've just completed your first project. Now watch what happens when people find out that you make jewelry. Your friends will want their broken jewelry repaired and new jewelry created. You'll be surprised how many people you know will stop you on the street or in the grocery store, reach into their pocket or purse, and pull out a piece of jewelry that

needs fixing. These repair jobs lead to relationships with customers who will often think of you first when they consider purchasing jewelry. Keep practicing—you're well on your way to a great career!

Practice: Making the Pendant

<https://courses.portal2learn.com/d2l/common/dialogs/quickLink/quickLink.d2l?ou=16900&type=quiz&rCode=c6d13a79463f4dcc06c97c3-8>